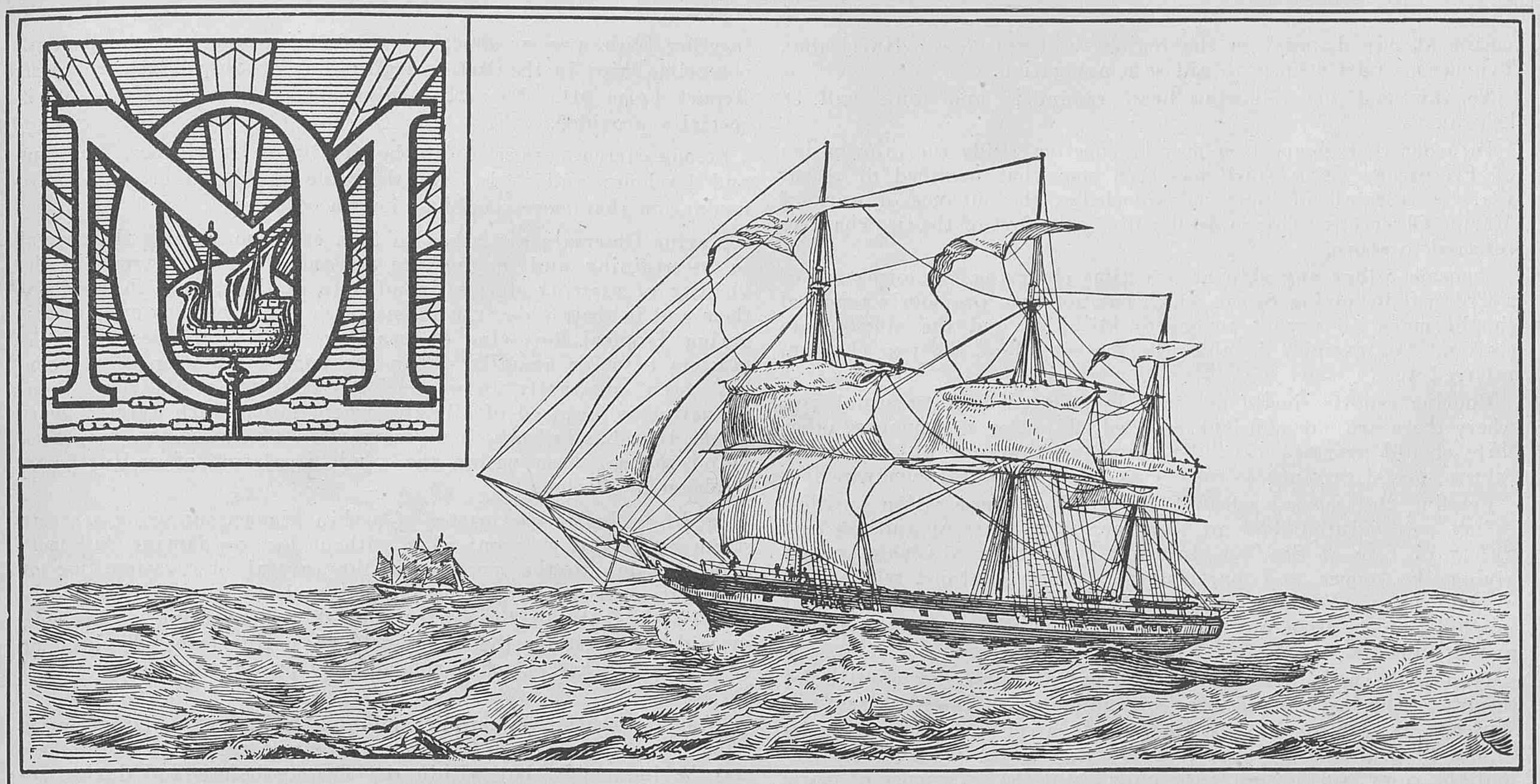
FOR OFFICIAL USE

M.O. 262.



VOL. VI. No. 67. THE MARINE OBSERVER. JULY, 1929.

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TROPICAL REVOLVING STORMS AND SAFE NAVIGATION.

With July, the season of Tropical Revolving Storms—Hurricanes, Typhoons or Cyclones according to locality—is upon all who navigate Northern Tropical Seas; and before the end of this season in November, north of the Equator, cyclones may be expected in the Southern tropics in the Indian Ocean and Hurricanes in the Pacific.

All the year round these storms occur in one or more regions of the Tropical Seas.

Special vigilance for these storms is necessary.

The loss of *Okara*, *Valerian*, *Eastway*, *Elkton* and other vessels of recent years is proof, if proof is needed, of the need for special precautions.

The British Corps of Voluntary Marine Observers are reminded of the information, method of observation, and modern cyclone navigation given in Chapters IV and V of Wireless and Weather an Aid to Navigation and they will find other useful information throughout the Volumes of this journal.

Not only are our Corps asked to do all in their power by their own efforts of observation, communication and practical application, but they are also asked to bring to the notice of Commanders and officers of ships who are not on our list the advantages to be gained by use of the system.

On the reverse side of the North Atlantic Ice Chart in the May number along with the monthly notices we published a copy of a notice of the Royal Society of Arts regarding the Thomas Grey Memorial Trust Prizes for the improvement and encouragement of navigation. Thomas Grey was the author of that well-known rhyme commencing—" When both side lights you see ahead
Port your helm and show your Red "
and for some time assistant Secretary of the Mercantile Marine Department, Board of Trade.

This year, the subject is of unusual interest to Marine Observers.

A prize of £50 is offered for an essay on the following subject :—

> " You are overtaken by a revolving storm. Discuss the handling of a low-power steamer from the time of the first indication of the approach of the storm until the storm has passed, supposing the ship to be in (*a*) the safe semi-circle ; (*b*) the dangerous semi-circle and (*c*) the direct path of the storm's centre."

All interested should refer to this notice.

Here is a fine opportunity, for not only is there a handsome prize to be won, but who knows, those competing may succeed in putting forward information, experience and ideas which may lead to general improvement in the Laws of Storms. But to return to vigilance at sea, the great thing is to do all in our power with the

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means at our disposal in the regions and seasons of Hurricanes, Typhoons, and Cyclones to aid safe navigation.

To this end the following brief reminders and hints will be helpful.

In order that observation may be effective, study the information of Precursory signs which has been somewhat modified of recent years as a result of improved knowledge, the outcome of work of Marine Observers. This is dealt with in the first of the two chapters referred to above.

Remember that any ship at any time observing the formation of a Tropical Revolving Storm which has not been previously reported should make an urgent report to all ships and the appropriate station. An example is given in the second of the two chapters referred to.

Routine reports should be made by selected ships as usual and where there are not sufficient Selected Ships for this purpose other ships should assist by carefully following the same procedure and taking special care not to cause congestion in W/T communication.

Pending the general schedule for W/T communication outlined in my note "Intelligence of Weather, Tide, Current and Ice and Safety of Life at Sea," as information becomes available we are giving the names and particulars of those stations which will receive routine Weather reports from Selected Ships and urgent weather reports from any ship, in Weather Signals in the appropriate numbers.

Then as to how to make the best use of reports received: plot them as soon as possible, the examples given in WIRELESS AND WEATHER AN AID TO NAVIGATION provide a guide. When it comes to handling the ship, shaping a course, or heaving to, remember that the rules laid down are the outcome of the experience of many seamen for many years in many ships in many storms. If it had not been for the experience of those in sailing ships, who scudding all the time, turned 32 points of the compass, should we have known so long that these storms revolve?

There is still much to learn about these storms and also of handling ships in and near them. Therefore all encountering them are asked to carefully make and record observations and return them, together with a clear description of their experience. Regular observing ships in the Meteorological Log or Ship's Meteorological Report Form 911. For other ships not on our list Form 905 is specially provided.

Strong currents are set up in the vicinity of Hurricanes, Typhoons and Cyclones and it is very desirable in the interests of safe navigation that more should be known of these.

Marine Observers are asked to take even more pains than usual in ascertaining and logging the set and drift of current in the vicinity of existing storms, in advance of them, on either side of them and in their wake. In recent years when charting and investigating Tropical Revolving Storms there have been cases where the Masters of ships actually within the wind circulation of a storm have been apparently unaware of the existence of the storm. Information is required of all cases where ships which were unaware at the time but by subsequent comparison of experiences have been found to have been within the wind circulation of a Hurricane, Typhoon or Cyclone.

Credit is due to the master of a ship who encountering a severe storm brings his ship out of it without loss or damage, but most credit is due to the master who by careful observation, use of information received from other ships and stations, skilful estimation of the path of the vortex and skilful handling of his ship succeeds in avoiding the storm field of a Hurricane, Typhoon or Cyclone altogether, which is subsequently proved to have threatened his ship.

After recurvation in middle and high latitudes revolving storms often cover a great area and travel at great speed; to avoid them may be impossible, but within the Tropics before and during recurvature they travel at a comparatively slow speed, are smaller in extent and more intense. Here is where skilful cyclone navigation may prove most effective and we hope that during the coming seasons the Commanders of British Ships will have success and send in careful records of their experiences.

London.
5th April, 1929. MARINE SUPERINTENDENT.

THE MARINE OBSERVER'S LOG.

It is hoped that these pages will be filled each month with a selection of the contributions of Mariners in manuscript, or remarks from the Logs and Reports of regular Marine Observers.
Responsibility for statements rests with the Contributor.

CURRENTS, FLOATING ICE AND WEATHER CONDITIONS ALONG THE TRACKS FROM LATITUDE OF THE PLATE TO CAPE HORN.

THE following remarks are replies to the notes under this heading which were published on page 27 of Volume VI No. 62.

Captain A. W. MCKELLAR, R.D., R.N.R.—S.S. *Ruapehu.*

"You ask for some remarks on the Cape Horn route from New Zealand. I have had no experience on this since 1915, but up to that date we always went that way and the constant anxiety was from so much thick weather and the presence of Ice, more especially in the Summer and Autumn. On reference to old abstract logs I note the drift to the East was fairly constant but not great; I have never in my experience in steam sighted Ice North of the Horn, but it was the practice to pass through the Straits of Le Maire, and thus to avoid it. From Cape Horn to the mouth of the Plate the current nearly always ran to the N.E., sometimes over 30 miles a day, and unless the Southern land was not visible we usually passed to the west of English Bank. When bound to Monte Video, a central reporting station for Ice at the Falklands would be extremely useful, if the positions of Ice seen were broadcast; but to be of any use from Longitude 140° W. to Longitude 90° W. where ice is usually met, the station would have to be efficient enough to reach those parts, and in my opinion, that is the most important locality to be notified about ice. I should like to take the opportunity of congratulating you on the MARINE OBSERVER which is extraordinarily interesting and useful to Navigators, and in fact I should venture to say absolutely necessary to the up-to-date seaman."

Captain J. BURTON DAVIES—S.S. *Tongariro.*

"During my service in the New Zealand Shipping Company, I have made 10 voyages from Wellington to Monte Video via Cape Horn, the last two being in Command of *Hurunui* from 1923 to 1926. On all except these last two voyages I have encountered Ice between Longitudes 147° and 99° 20′ W. It has been my experience that as Cape Horn is approached the risk of Ice diminishes, although of course, I have occasionally received reports of Ice on the route between Staten Island and Monte Video without actually sighting it myself.

"I think that for those vessels who are still using the Cape Horn route, an ice warning service to be established on Falkland Island would be of very great assistance, especially if arrangements were made between this Station and those Companies still using the Cape Horn Route, for any information of Ice obtained by the Ice Warning Station to be telegraphed to New Zealand so that this information could be passed on to vessels prior to sailing."

Captain F. W. ROBINSON—S.S. *Tekoa.*

"The charts in the February number appear from my records to give a much closer approximation of currents in the Cape Horn vicinity than the older charts, which all appear to exaggerate them.

"The track which I always follow from New Zealand to Cape Horn is the old New Zealand Shipping Companies' track, viz.:—

"On leaving New Zealand converge on Latitude 48° 30′ S., Longitude 165° W. thence—

Latitude 49° 00′ S.,	Longitude 160° W.,
,, 49° 30′ S.,	,, 150° W.,
,, 50° 00′ S.,	,, 140° W.,
,, 50° 50′ S.,	,, 130° W.,
,, 51° 30′ S.,	,, 120° W.,
,, 52° 10′ S.,	,, 110° W.,
,, 52° 45′ S.,	,, 100° W.,
,, 54° 00′ S.,	,, 90° W.,
,, 55° 00′ S.,	,, 80° W.,

thence to Cape Horn.

"The greater distance is to my mind more than compensated for by the freedom from ice, personally I have not seen ice on this track.

"The suggestion that Falkland Island W/T Station should broadcast ice reports is a sound one.

"The present system which no doubt you are aware, is for any vessel sighting ice to cable back from Monte Video the position, etc., to New Zealand. The objection to this is, of course, that sometimes these reports are a month old or more by the time the next vessel sails."

Captain W. A. R. Kershaw—S.S. *Mataroa.*

"My experience of the home run from New Zealand via Cape Horn goes back to 1908 from 1926.

"During these years I have seen many ice bergs in spite of our Company's track being laid off to keep to the northward of the ice latitude.

"Those who have had the experience of keeping their watch night after night in the Southern Ocean, know, that in the event of collision with ice it would be many days before assistance could be given, and are the only ones who can understand the heavy strain that the Master of a ship is put to at these times.

"If any ice was sighted during the voyage, its position would be telegraphed through to New Zealand from Monte Video.

"When chief officer of the S.S. *Tainui* in 1913, with a full ship of passengers, we found at daybreak that we had passed four big bergs and had to alter course many times during the remainder of the watch. At noon the course was altered to clear the ice before nightfall.

"I have seen the most ice in the summer months, November, December, and January, from 110° W. onwards, but have never seen any 'even when 100 miles south of our track' in June or July.

"In the present days of wireless, I should think it would be a great safeguard to life and property, if ships would report sighting any ice to Falkland Island and have it broadcast from there on the 1600 wave length, which would reach ships in 100° W.

"If broadcast on the 600 wave length a ship is nearly up to the Cape before anything can be made of it, owing to the constant and heavy jamming from the West coast stations."

Captain H. E. Elford—R.M.S. *Tainui.*

"The passenger mail steamers of this line have for some years past made the voyage Homewards from New Zealand via the Panama Canal. The cargo vessels of the Company however, continue to proceed homeward via Cape Horn, Monte Video and Teneriffe. Previous to my appointment of the command of this vessel, I was for a number of years, in command of several of the cargo vessels and made the passages homewards as stated.

"During this time I have been very fortunate in not encountering ice, excepting on one occasion when one solitary berg was sighted in Latitude 49° 15′ S., Longitude 155° 0′ W. This particular berg had a long career and was sighted by a number of vessels over a long period of several months. It was named Westminster Abbey owing to its formation resembling the famous church.

"Several of the commanders on our route have enjoyed a like freedom from ice and which probably may be due to the track our Company has laid down that we shall take, as follows:—Vessels leaving New Zealand will converge on Longitude 165° West and Latitude 48° 30′ S., and then the respective meridians to be crossed as follows:—

160° West	crossed in	Latitude	49° 0′ S.
150°	,,	,,	49° 30′
140°	,,	,,	50° 0′
130°	,,	,,	50° 50′
120°	,,	,,	51° 30′
110°	,,	,,	52° 10′
100°	,,	,,	52° 45′
90°	,,	,,	54° 0′
80°	,,	,,	55° 0′

"Thence to a safe distance passing Cape Horn.

"In fine clear weather and during the hours of daylight if passage is taken between Staten Island and the mainland, ice is never encountered and but seldom between Staten and the Falkland Islands.

"There are occasions during heavy Westerly gales and high seas off Cape Horn when it is not prudent to round vessel too quickly to the Northward, and vessels run then further West and round gradually and so pass to the Eastward of the Falklands, there is then great likelihood of meeting ice as bergs of considerable size foregather in this vicinity.

"In my opinion an Ice Warning Station on the Falklands would be of great value and a comfort to mariners. Every vessel in passing, to radio the station what track they have taken and whether or not encountered ice.

"Masters accustomed to this route and in spite of an Ice Warning Station on the Falklands would not be led into a false sense of security by a report of 'No Ice Reported' as they will always have in mind ice moves with great rapidity in these waters, and this report may mean a very different state of affairs for vessels passing 48 hours later when ice may then abound.

"Trusting that this may be of interest, and in conclusion state that how we of the Voluntary Corps of Observers look forward with pleasure and interest to receiving each month that wonderful and valuable work The Marine Observer."

DISCOLOURED WATER.

West Coast of Australia.

The following extract is from the Meteorological Log of S.S. *Gascoyne*, Captain L. Johnson, Derby to Sourabaya, Observer, Mr. J. S. McBryde.

"On July 6th, 1928, on a passage from Derby to Sourabaya, the above vessel passed through a very large patch of discoloured water, with a very clearly defined dividing line. Our course was along the northern limit of the patch which extended in a N.W. and S.E. direction from Latitude 15° 51′ S., Longitude 122° 35′ E. to Latitude 15° 43′ S., Longitude 122° 27′ E., and appeared to be three or four miles wide.

"There was a considerable quantity of floating seaweed in the vicinity."

Red Sea.

The following is an extract from the Meteorological Log of S.S. *Port Nicholson*, Captain J. Jack, Aden to Port Said, Observer, Mr. W. B. Hopkins.

"July 9th, 1928, at 7.20 p.m. A.T.S. in Latitude 20° 45′ N., Longitude 38° 32′ E., the vessel ran into a very light coloured patch of water, approximately 1,600 feet wide, and four miles long. This discoloured patch ended with remarkable abruptness, after keeping a uniform width and direction, which was 328°."

PHOSPHORESCENCE.

Arabian Sea.

The following is an extract from the Meteorological Log of S.S. *Glenamoy*, Captain C. E. Homan, Suez to Penang, Observer, Mr. R. W. Emerson.

"July 16th under Lee of Sokotra Island in Latitude 13° 11½′ N., Longitude 53° 51′ E. From 1.54—1.56 a.m. vessel passed through brilliant streak of Phosphorescence, composed of large globules in small groups and singly. Single globes were radiating a greenish light for a considerable radius, the direction of the Streak was N.N.E. and S.S.W.

"When sighted it had the appearance of breakers on shore. No Phosphorescence had been observed before and only occasional small globules after, during the watch.

"Weather at the time was Wind S. by W., force 4. Sea, South, disturbance 4-5. Confused S.E. swell. Moderate to Rough. Barometer 1002.3 mb. Temperature Air 77°.7. Sea 76°."

REPORT OF A TYPHOON.

China Sea.

THE following report has been received from S.S. *Rajputana*, Captain F. G. CADIZ, D.S.C., Kobe to Yokohama.

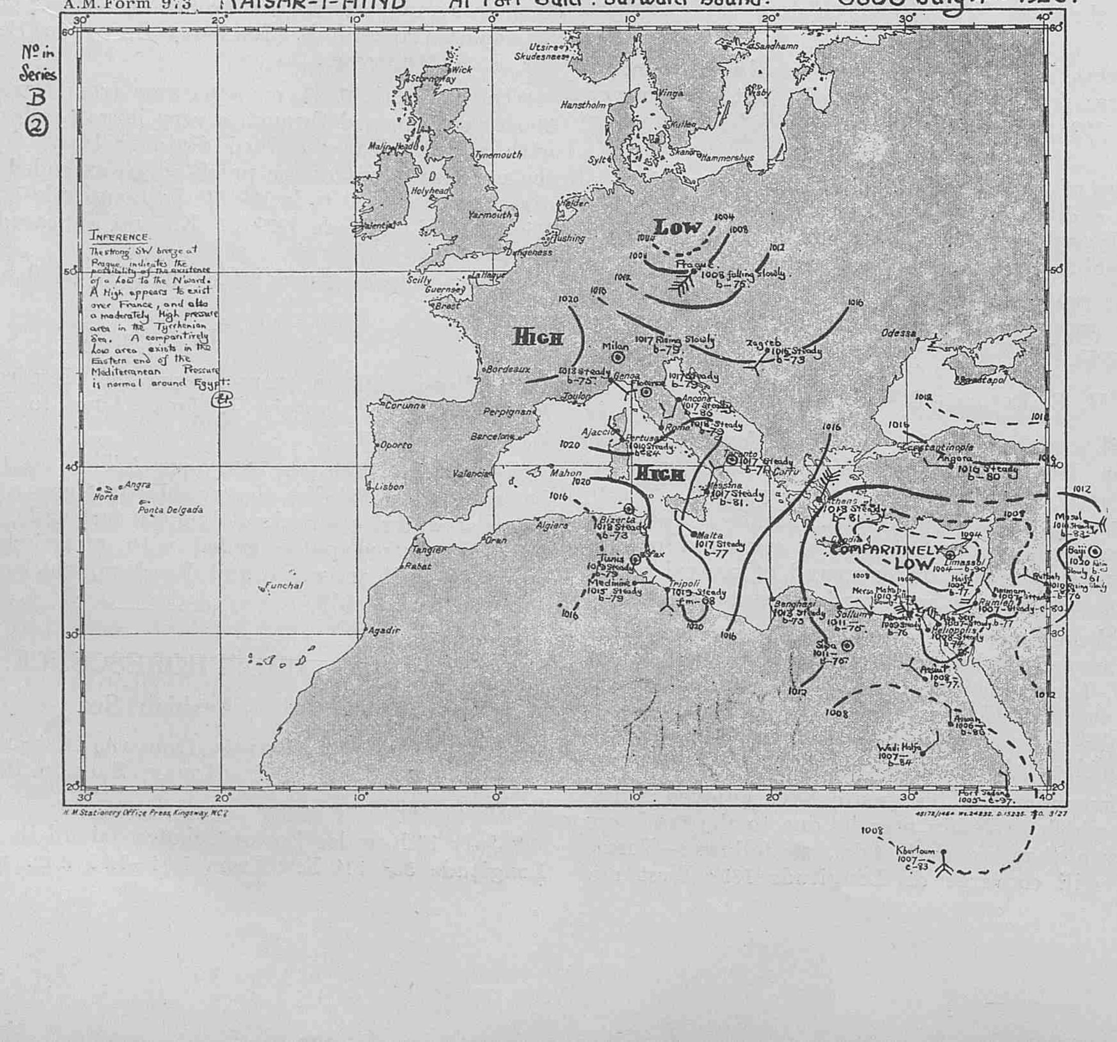
"Leaving Kobe at 7.22 a.m., on 30th July, 1928, and steering various courses Siwo Misaki Lighthouse was rounded at 2.04 p.m., when a course of 68° was then set. The weather had been overcast up to this time with an increasing Easterly swell and a falling barometer. The wind at noon had been from the N.W., force 4, but later in the afternoon veered to the N.N.E. The weather now began to set in bad, with a very high Easterly sea and swell, frequent fierce rain squalls and poor visibility. At about 11.10 p.m. that night the wind was blowing from the N.E., force 8, the barometer was still falling and the weather conditions so unfavourable that it was decided unsafe to proceed much further. The ship was turned sixteen points and ran for about two hours on a course of 248°. From noon to midnight the barometer had dropped altogether a matter of 24/100ths: At 1.30 a.m. on the 31st the barometer became steady and at the same time the wind backed towards the N.W. and blew force 6. As the weather conditions seemed more favourable the ship was now turned back sixteen points and resumed her former course of 68°. Overcast and continuous rain with a high Easterly sea and swell were now the general conditions prevailing and which lasted throughout the day. At 9.00 a.m. land was observed to port but soon became obscured by rain. Speed was eased accordingly. However at 10.00 a.m. Omai Saki Lighthouse was observed bearing N. 9° E. distance 17 miles. During the earlier part of the morning the wind had been from the N.N.W., force 7 to 8, but now veered to the N.E., force 7, with fierce rain squalls and a falling barometer. The position at noon on the 31st by bearings was Latitude 34° 28′ N. and Longitude 138° 40′ E. The wind now backed to the North, force 8, and weather conditions again became so unfavourable to proceed that the ship was turned 16 points to a course of 245° and ran until nearly 4 p.m. when improving weather conditions allowed of the ship once more to be resumed to her proper course of 68°. At 7.40 p.m. Omai Saki Light was observed bearing N. 28° E., distance 24 miles. The weather now at this time was overcast with frequent heavy rain squalls and with a very confused high sea and swell running, the wind being from the N.E., force 8. Early in the morning of the following day the general weather conditions improved so as to make it possible for the ship to proceed to her destination which was reached about noon with the wind now coming from the N.E. at force 3. Continuous rain was experienced throughout that day at Yokohama. During the whole of this time continual weather reports gave the centre of the typhoon in about approximately 30° N. and 131° E., nearly stationary or moving in a Westerly direction very slowly."

WEATHER CHARTS MADE AT SEA.

Weather Charts (three of a series) made at sea on board S.S. *Kaisar-i-Hind*, Captain G. MANLEY, London to Bombay,
by Mr. R. H. HAND.

Mediterranean.

A.M. Form 973 "KAISAR-I-HIND" At Port Said : outward bound. 0600 July 4TH 1928.



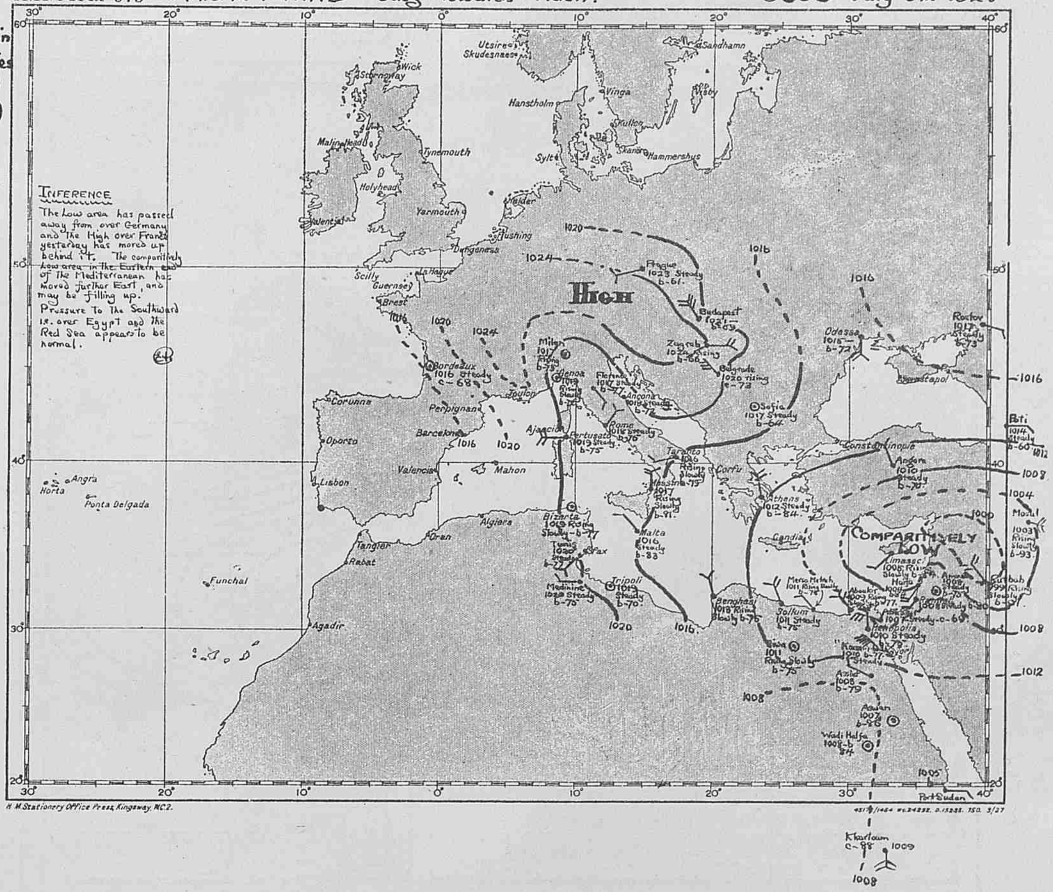
Nº in Series B ②
LOW
HIGH
HIGH
COMPARITIVELY LOW
Milan
Bordeaux
Genoa
Corunna
Oporto
Lisbon
Perpignan
Barcelona
Valencia
Mahon
Algiers
Oran
Tangier
Rabat
Funchal
Agadir
Angra
Horta
Ponta Delgada
Wick
Stornoway
Tynemouth
Holyhead
Yarmouth
Scilly
Guernsey
Brest
Flushing
Dungeness
Utsire
Skudesnaes
Hanstholm
Vinga
Kullen
Sandhamn
Visby
Sylt
Skagen
Hammershus
Zagreb
Odessa
Sevastopol
Constantinople
Angora
Florence
Rome
Ancona
Ajaccio
Malta
Tripoli
Tunis
Bizerta
Benghazi
Sollum
Athens
Corfu
Messina
Limassol
Haifa
Beirut
Siwa
Wadi Halfa
Aswan
Port Sudan
Khartoum
30°
20°
10°
0°
10°
20°
30°
40°
60°
50°
40°
30°
20°

INFERENCE
The strong SW breeze at Prague indicates the ~~possibility of the existence~~ of a Low to the N'ward. A High appears to exist over France, and also a moderately High pressure area in the Tyrrhenian Sea. A comparitively low area exists in the Eastern end of the Mediterranean Pressure is normal around Egypt:

Red Sea.

A.M. Form 973 "KAISAR-I-HIND" Suez towards Aden. 0600 July 5th 1928

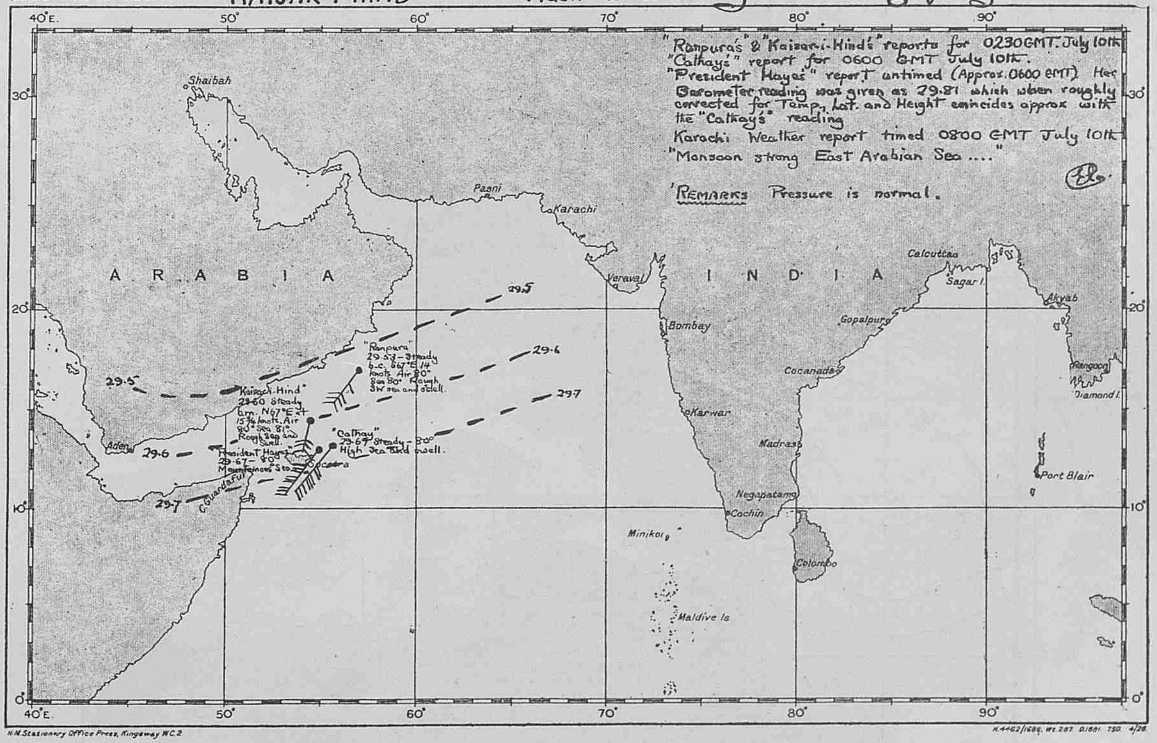
No. in Series B ③


HIGH
COMPARITIVELY LOW
1024
1020
1016
1012
1008
1004
1000
Budapest
Zagreb
Belgrade
Sofia
Odessa
Rostov
Sevastapol
Constantinople
Angora
Athens
Candia
Limassol
Beirut
Mersa Matruh
Sollum
Benghazi
Tripoli
Malta
Tunis
Bizerta
Medenine
Milan
Genoa
Florence
Ancona
Rome
Naples
Messina
Taranto
Ajaccio
Bordeaux
Perpignan
Barcelona
Valencia
Mahon
Algiers
Oran
Tangier
Rabat
Lisbon
Oporto
Corunna
Brest
Guernsey
Scilly
Valentia
Holyhead
Malin Head
Stornoway
Wick
Tynemouth
Yarmouth
Flushing
Dungeness
La Hague
Helder
Sylt
Hanstholm
Skagen
Hammershus
Utsire
Skudesnaes
Vinga
Sandhamn
Agadir
Funchal
Angra
Horta
Ponta Delgada
Siwa
Assuan
Wadi Halfa
Port Sudan
Khartoum
1008
H.M. Stationery Office Press, Kingsway, W.C.2.

INFERENCE
The Low area has passed away from over Germany and the High over France yesterday has moved up behind it. The comparitively Low area in the Eastern end of the Mediterranean has moved further East, and may be filling up.
Pressure to the Southward i.e. over Egypt and the Red Sea appears to be normal.

Arabian Sea.

A.M Form 1297. "KAISAR-I-HIND" Aden to Bombay Morning of July 10th. 1928.


ARABIA
INDIA
Shaibah
Pasni
Karachi
Veraval
Bombay
Calcutta
Sagar I.
Akyab
Gopalpur
Cocanada
Rangoon
Diamond I.
Karwar
Madras
Port Blair
Negapatam
Cochin
Minikoi
Colombo
Maldive Is
Aden
C. Guardafui
Socotra
29.5
29.6
29.7
"Ranpura" 29.53 - Steady b.c. S67°E 14 knots Air 80° Sea 80° Rough SW sea and swell.
"Kaisar-i-Hind" 29.60 Steady b.m. N67°E at 15¾ knots. Air 80° Sea 81° Rough sea and swell.
"Cathay" 29.67 Steady - 80° High sea and swell.
"President Hayes" 29.67 - 80° Mountainous Sea
H.M. Stationery Office Press, Kingsway W.C.2

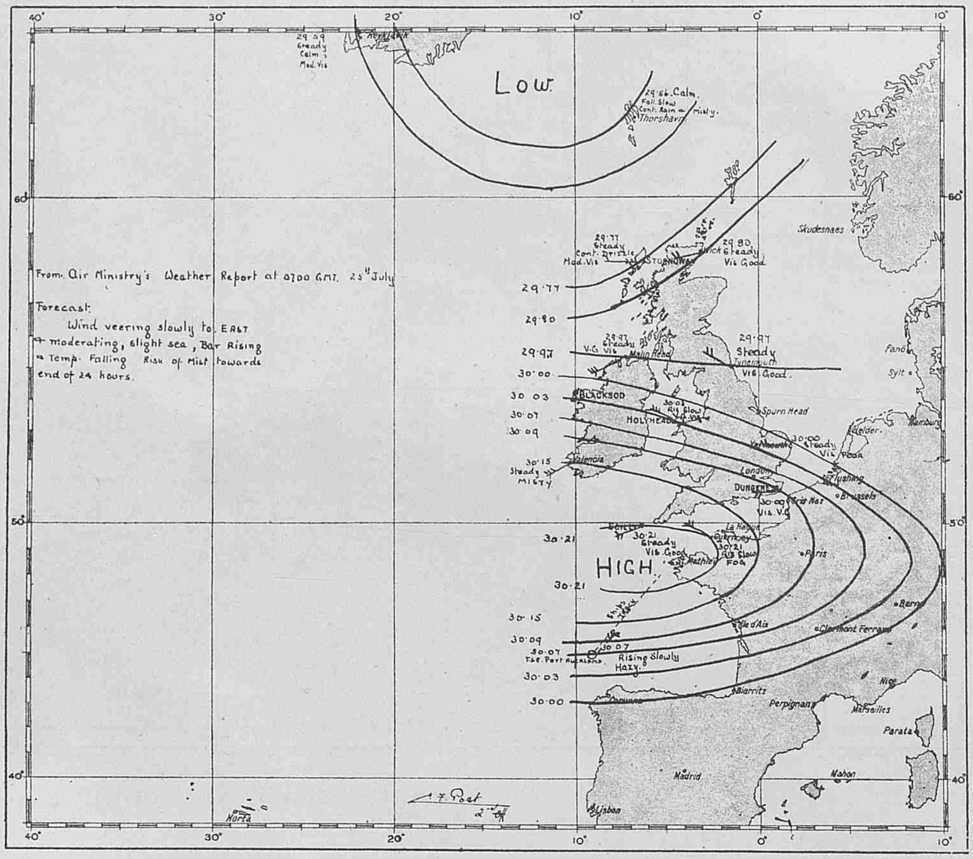
"Ranpura's" & "Kaisar-i-Hind's" reports for 0230 GMT. July 10th
"Cathay's" report for 0600 GMT July 10th.
"President Hayes" report untimed (Approx. 0600 GMT). Her Barometer reading was given as 29.81 which when roughly corrected for Temp, Lat. and Height coincides approx with the "Cathay's" reading
Karachi Weather report timed 0800 GMT July 10th
"Monsoon strong East Arabian Sea ...."

REMARKS Pressure is normal.

WEATHER CHARTS MADE AT SEA (*continued*).

Eastern North Atlantic.

Weather Chart made at sea on board S.S. *Port Auckland*, Captain R. S. DURHAM, D.S.C., New Zealand to London, by Mr. C. F. POST, 2nd Officer.

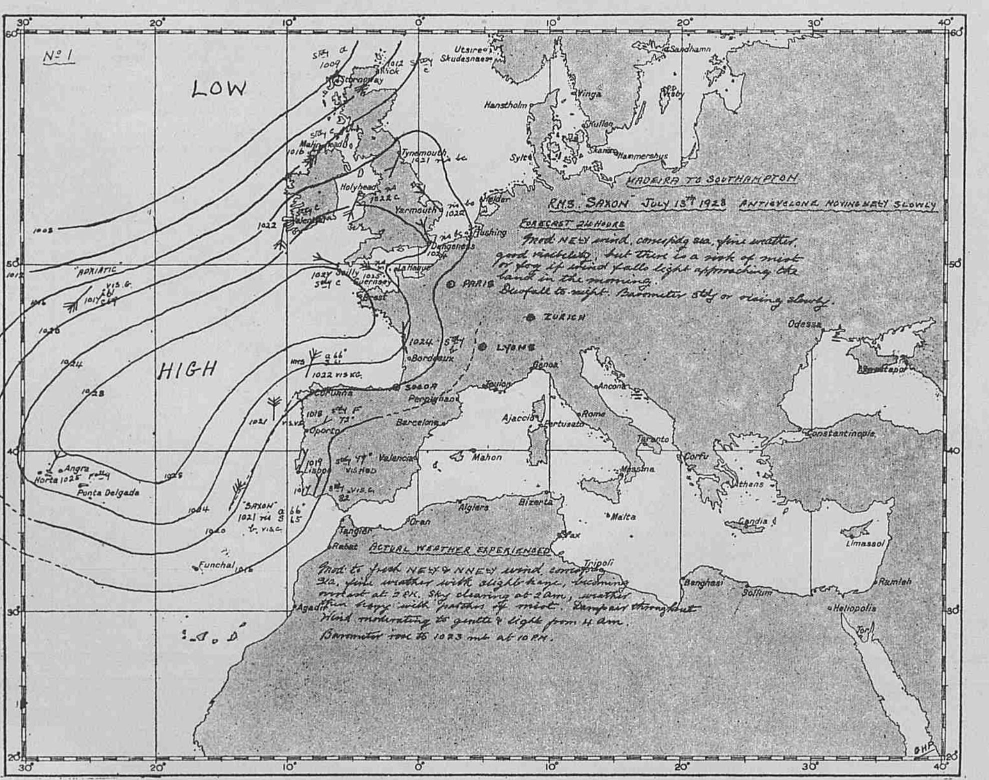

40°
30°
20°
10°
0°
10°
60°
50°
40°
LOW
HIGH
29·59 Steady Calm Mod. Vis
Reykjavik
29·56. Calm. Fall Slow Cont. Rain & misty.
Thorshavn
Skudesnaes
29·77 Steady Cont. Drizzle Mod. Vis
Stornoway
Wick
29·80 Steady Vis Good
29·77
29·80
29·97 Steady V.G. Vis
Malin Head
29·97
29·97 Steady
Tynemouth
Vis Good.
Fanö
Sylt
30·00
30 03
Blacksod
30·03 Ris Slow V.G. Vis
Holyhead
30·07
30·09
Spurn Head
Helder
Hamburg
Yarmouth
30·00 Steady Vis Poor
30·15 Steady MISTY
Valencia
London
Flushing
Brussels
Dungeness
30·09 Gris Nez Vis. V.G.
30·21
Scilly
30·21 Steady Vis. Good
La Hague
Guernsey
30·21 Ris Slow FOG
St. Mathieu
Paris
30·21
Ship's Track
30·15
30·09
30·07 T.S.P. Port Auckland
30·07 Rising Slowly Hazy.
30·03
30·00
Ile d'Aix
Clermont Ferrand
Berne
Biarritz
Corunna
Perpignan
Marseilles
Nice
Parata
Madrid
Mahon
Lisbon
Horta
C F Post 2nd Off

From. Air Ministry's Weather Report at 0700 GMT. 25th July

Forecast:
Wind veering slowly to EAST
& moderating, slight sea, Bar Rising
& Temp. Falling Risk of Mist towards
end of 24 hours.

According to *Port Auckland's* Meteorological Log the wind veered to E.N.E. dropping to force 2 at midnight. Patches of mist were experienced between 5 and 8 p.m. of the 25th.

Weather Chart (one of a series) made at sea on board R.M.S. *Saxon*, Captain G. F. GARDNER, O.B.E., Cape Town to Southampton, by Mr. G. H. PICKERING.


30°
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10°
20°
30°
40°
60°
50°
40°
30°
20°
No. 1
LOW
HIGH
1009
Stornoway
1012
Wick
Utsire
Skudesnaes
Hanstholm
Vinga
Wisby
Kullen
Skanör
Hammershus
Sylt
Malin Head
1016
Tynemouth
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Helder
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La Hague
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Rome
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Agadir
Sfax
Tripoli
Malta
Messina
Taranto
Corfu
Athens
Candia
Benghazi
Sollum
Limassol
Rumleh
Heliopolis
Tor
Constantinople
Sevastopol
Odessa
GHP

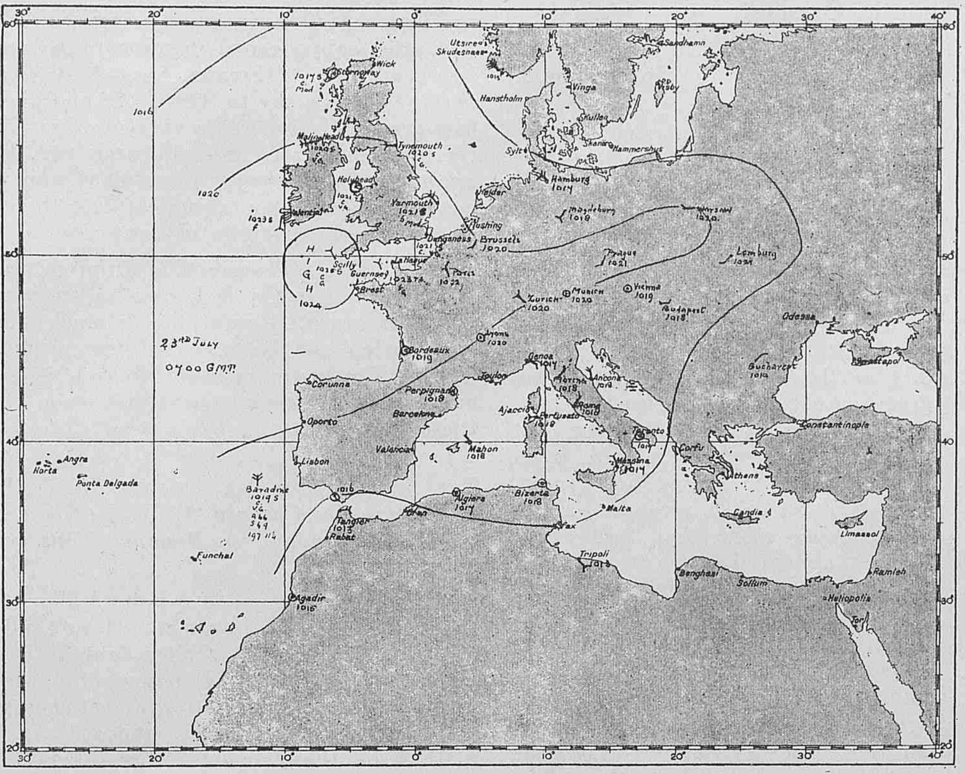
MADEIRA TO SOUTHAMPTON

R.M.S. "SAXON" JULY 13th 1928 ANTICYCLONE MOVING NE'LY SLOWLY

FORECAST 24 HOURS
Mod. NE'ly wind, confused sea, fine weather,
good visibility, but there is a risk of mist
or fog if wind falls light approaching the
land in the morning.
Dewfall to-night. Barometer st'dy or rising slowly.

ACTUAL WEATHER EXPERIENCED
Mod. to fresh NE'ly & NNE'ly wind, confused
sea, fine weather with slight haze, becoming
overcast at 5 P.M. Sky clearing at 2 am, weather
then hazy with patches of mist. Damp air throughout
Wind moderating to gentle & light from 4 am.
Barometer rose to 1023 mb at 10 P.M.

Weather Chart (one of a series) made at sea on board S.S. *Baradine*, Captain W. Rollo, London to Australia, via Cape of Good Hope, by Mr. C. B. Roche, Chief Officer.


23rd July
0700 G.M.T.
Baradine
Wick
Tynemouth
Holyhead
Yarmouth
Scilly
Guernsey
Brest
Hamburg
Brussels
Prague
Lemberg
Zurich
Munich
Vienna
Budapest
Bordeaux
Lyons
Corunna
Oporto
Lisbon
Perpignan
Barcelona
Valencia
Mahon
Genoa
Toulon
Ajaccio
Algiers
Bizerta
Oran
Tangier
Rabat
Funchal
Agadir
Angra
Horta
Ponta Delgada
Malta
Tripoli
Benghazi
Sollum
Ramleh
Heliopolis
Limassol
Candia
Athens
Corfu
Messina
Taranto
Constantinople
Bucharest
Sevastopol
Odessa
Hanstholm
Sylt
Skudesnaes
Utsire
Vinga
Hammershus
Sandhamn
Helder
Flushing
Dungeness

EXCEPTIONAL VISIBILITY.

On the Coast of Peru.

The following is an extract from the Meteorological Report of S.S. *Orduna*, Captain T. Daniel, Havana to Callao, Observer, Mr. R. D. Eckford, 3rd Officer.

"30th July, 1928. Weather during the forenoon was heavily overcast with St. and St. Cu. Clouds, mist of varying density and poor visibility. At 1330 at ship (1830 G.M.T.) in Latitude 9° 15′ S., Longitude 79° 09′ W. the cloud bank suddenly cleared moving rapidly off to the N.W. The land became visible, without any distortion due to refraction or other causes, nor was there any haze. The foothills and mountains rose tier on tier, from Mounts Chimbote and Division on the coast to Mount Huascayan—a ridge of the Eastern Andean Cordillera, and the only portion of the range of sufficient height to be visible from the ship's position. Mount Huascayan rises to the height of 22,051 feet, the summit being well above the line of perpetual snow. Its each feature was vividly distinct. Form and colour were as apparent as if the mountain stood less than a mile away, though our actual distance was 92 miles.

"Towards 17.30 clouds formed around the coastal ranges obscuring them, but the high peaks and ridges of the main cordillera remained clear-cut and distinct until finally lost to view in the gathering dusk."

MIRAGE

Off East Coast of Scotland.

The following report from the Steam Trawler *Star of the Ocean*, Skipper Alexander Robb has been forwarded by Commander Leslie D. Fisher, R.N., of the Fishery Board for Scotland.

"On the afternoon of 12th July, 1928, we were fishing 54 miles S. by E. from Aberdeen. The weather was calm and clear. Four trawlers were working round a dan buoy about a mile inside where we were. About 5 p.m., one of the crew asked where the big boats had come from. A slight haze seemed to be over the four trawlers, two of which appeared easily ten times their normal size, shaped something as in Figure 1, and very dark in colour.

"After a few minutes, one of them seemed to develop three horizontal spaces which made her look like a full rigged sailing ship. The second one faded more quickly to normal with a perfect reflection in the water. (Figure 2.)

"The other two ships appeared to be outside the haze, as only their foremasts and funnels were enlarged, mizen masts appearing normal. (Figure 3.) This phenomenon lasted more than half-an-hour. Boats three or four miles away were quite normal during that time.

"Some of the crew have forty years sea experience and have never witnessed such a sight before."

Figure 1.

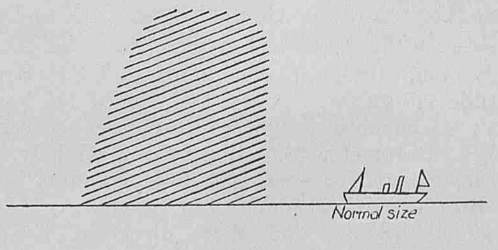

Normal size

Figure 2.

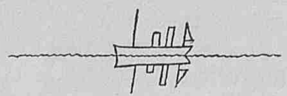
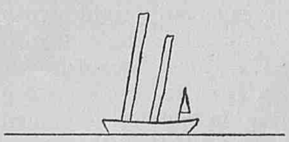


Figure 3.



AURORA.

Aurora Borealis.

North Atlantic Ocean.

THE following is an extract from the Meteorological Log of S.S. *Port Dunedin*, Captain F. FARMAR, Colon to Southampton. Observer, Mr. E. G. JONES.

"July 7th, 1928, in Latitude 37° 22′ N., Longitude 43° 24′ W. Course 54°. Speed 14 knots, at 8.00 p.m. twilight had not faded, the horizon being clearly defined all round the compass. 8.30 p.m., complete darkness having fallen, the horizon was only distinguished with difficulty.

"About 8.45 p.m. a strong white glow was observed at an altitude of 4 to 10 degrees from North to N.W. This white glow resembled the glow of a full moon hidden by cirrus clouds, and was strong enough to render all stars, except those of the 2nd magnitude, invisible. This white glow continued steadily until 10 o'clock p.m. (8th: 0105 G.M.T.), when various brilliant green patches were observed. These patches, which were about 5 degrees of an arc in diameter, but without any clearly defined edge, first appeared as a dim green light, gradually growing in strength, and then fading again completely, the whole cycle occupying about 20 to 25 seconds. About 20 of these patches were observed, never more than two being visible at the same time. They never appeared at a greater altitude than 10 degrees above the horizon, 4°—5° being the usual altitude.

"Position at 10.00 p.m. A.T.S., Latitude 37° 42′ North, Longitude 42° 50′ West. Clouds Cu. amount 4. Wind S.E., force 3. Barometer 1026.3mb. steady. Temperature 73° F.

"At 10.29 A.T.S., the moon rose behind the bank of cumulus clouds. At 10.45 A.T.S., a dull red glow, altitude 5°—35°, was observed bearing W.N.W. This gradually grew brighter, the colour ranging from faint pink to deep crimson, the whole being pierced by long straight beams—at right angles to the horizon—of strong white light. These beams obeyed the usual laws of aurora, fading and growing, shortening and lengthening. In the coloured patches, no stars were visible except those of the 2nd magnitude, which appeared white, except in the deep crimson patches where they appeared a light pink. The crimson and pink patches travelled very slowly to North and as slowly returned to W.N.W. although the sky from W.N.W. to North was at one time completely covered by these coloured patches, the white beams also being visible.

"At 11.25 A.T.S., the moon rising clear of the cumulus clouds, and gaining strength, further observations were rendered impossible. It was noted, however, that the North to North-Western horizon and sky was much brighter than is normally the case.

"The Wireless Operator reported slight statics, but no more than is usually experienced in these latitudes during the summer."

THE following is an extract from the Meteorological Log of S.S. *Elpenor*, Captain A. L. GORDON, New York to Port Said. Observer, Mr. J. E. ILIFF, 3rd Officer.

"July 7th, 1928, at 8.15 p.m. A.T.S., Latitude 40° 17′ N., Longitude 71° 32′ W. Course 96°, speed 13½ knots. Wind N.N.W., force 1; sea smooth; slight confused swell. Temperature: Air 64°, Sea 64½°. Barometer 30.05 in., falling slightly, visibility good, sky cloudless, except for small patch of cumulus low down to N.E., a long 'Bright Arc' was observed in the sky to the Southward extending in an East and West direction. This 'Arc' had the appearance of a heavy Cirrus cloud, but stars in 'Arc' were almost as bright as those outside. The 'Arc' attained an angular height of 30° at its highest point which bore S. by W. Below the arc sky was rather dark, while elsewhere it was unusually bright. At 8.50 p.m. this arc was beginning to fade rapidly and at 9 p.m. it had disappeared while sky was observed to be becoming more brilliant especially right overhead and about the vicinity of Vega. At 9.15 p.m. the whole sky from East to West through North had assumed a most beautiful appearance. Brilliant coloured rays radiated from a point overhead; and these rays were rapidly deepening in colour and then just as rapidly lightening. At the point of intersection the colour of the rays was bright with a very faint purple tinge, as they separated they seemed to become a more pronounced purple, and as they further separated they became a 'sunset red,' while an occasional ray had an ordinary bright appearance. In the vicinity of Vega there was a patch of sky a brilliant blood red in colour which reminded one of a very fine sunset; later this 'blood red' became tinged with purple. To the N.N.E. the sky had the appearance of a very fine dawn. At 9.45 p.m the sky was practically normal in appearance and the horizon to the N.E. was beginning to threaten fog. At 10.15 a second 'Bright Arc' was observed in the sky to the S.S.E. and about the same altitude as the first arc. This arc was a very peculiar shape and much smaller than the first one. A careful watch was kept on it and at 10.35 it gradually faded away. From 10.30 p.m. till 11.30 p.m. weather got hazy (visibility about 3 miles) and then cleared, the sky becoming overcast with light film of stratus."

NOTE.—The rays radiating from a point overhead at 9.15 p.m. were probably what is known as an auroral crown, a phenomenon which, however, is rare outside much more northerly latitudes. No explanation can be given of the bright arcs seen in the S. and S.S.E. The ordinary auroral arch is centred (in azimuth) at the magnetic north and is usually low on the horizon when seen from these latitudes.

THE following is an extract from the Meteorological Log of S.S. *Ruapehu*, Captain A. W. MCKELLAR, R.D., R.N.R., Southampton to New Zealand via Panama. Observer, Mr. L. F. MALCOURONNE, 3rd Officer.

"7th July, 1928, at 10.0 p.m. A.T.S., Latitude 31° 35′ N., Longitude 48° 55′ W. Barometer 1025.2 mb. Temperature Dry Bulb 76° Wet 70° Sea 76°. When first noticed at 10 p.m. a faint light almost similar to the first sign of dawn appeared on the northern horizon between the latter and a heavy cumulus cloud. The sun had been set three hours, and still an hour off moonrise, so that neither of these bodies were likely to be associated with the phenomenon. The illumination appeared to increase and decrease in brightness, and after 10.15 p.m. was not very noticeable. At 11 p.m. a faint red was visible over a portion of the sky, from the north point of the horizon to an altitude of 30°, cone shaped. The reddish appearance rapidly increased in brilliancy, and at ten minutes past eleven presented a very remarkable sight. It could at this time be compared with the reflection in the sky of a very large fire, as seen occasionally on land. At 11.15 p.m. the phenomenon disappeared, the moon then just rising in the S.E. quadrant and nothing further was seen during the night. The weather had been for some time very fine and settled and the atmosphere very clear, also on the day of observation a note appears in the log 'horizon exceptionally well defined.'"

THE following is an extract from the Meteorological Report of S.S. *Orbita*, Commander R. H. DOMINY, C.B.E., R.N.R., Cristobal to Vigo, Spain. Observer, Mr. I. LLOYD JONES, 3rd Officer.

"8th July, 1928, 0102 M.T.G. (7d. 9h. 54 p.m. at ship). Latitude 36° 16′ N., Longitude 43° 26′ W. Observed Auroral lights to Northward. Stratus cloud 2½° above horizon from 310° to 20°. Cloudless elsewhere.

0117: Brilliant illumination between 10° and 20° above horizon bearing 320°. Stratus cloud still stationary.

0137: Moon rose a fiery red colour and stars unusually brilliant.

0204: Distinctive reddish tint of aurora bearing 310°.

0210: White vertical rays from 20° to 40° altitude on a red background bearing 295°.

0215: Small cumulus cloud crossing lights, now bearing 340°, red colour more pronounced with constantly varying white beams. Altitude of deepest colour being 37° above horizon. Stratus clouds disappeared.

0225: Sky brilliant red between bearings 300° and 60° through 0° to an altitude of 40°. Clouds Cu 1/10 Altitude 5° bearing 000°.

0235: Light diminishing and moving to 030°.

0255: Sky normal, cloudless.

"Weather at Observation:—Wind E.S.E. 3, slight confused swell. Temperature at beginning 77° after 75°. Barometer 30.34 in. Steady.

Aurora Australis.

Australian Waters.

THE following is an extract from the Meteorological Log of S.S. *Port Melbourne*, Captain T. KIPPINS, Australian Ports. Observer, Mr. W. E. SIMPSON, 3rd Officer.

"July 8th, 1928, from 20.20 to 20.32 Standard Time (0832 G.M.T.), off Smoky Cape, New South Wales, Latitude 30° 15′ S., Longitude 153° 20′ E. Observed Aurora most distinctly. First appearing with white rays bearing 172° it gradually spread to 185° turning a brilliant red at an altitude of about 25° fading into pale yellow on the horizon. The whole slowly advanced westwards, being streaked with flickering white rays the advancing edge being led by a white streak frequently as brilliant as a searchlight. At 20.28 S.T. the white rays faded and the red curtain, or rather diffusion, turned paler until the whole disappeared bearing 210°. Visibility very good. Wind E.S.E. light. Barometer 1019.0 mb.

"The Aurora has also appeared in the 4-8 watch, but had not been so clearly defined, and being over the land could easily be mistaken for huge bush fires."

THE following is an extract from the Meteorological Log of S.S. *Tanda*, Captain E. T. PILCHER, Melbourne to Hobart. Observer, Mr. H. NUZUM.

"July 8th, 1928, off East Coast of Tasmania, at about 6.30 p.m., a faintly luminous pink glow appeared in the S.W. horizon. This gradually increased in brilliance until by 7 p.m. the whole S.W. quadrant of the sky was lit up by its glow. Patches of green then began to appear.

"Shortly after 7 p.m. the upper edges of the rather low-lying cumulus clouds were outlined with a vivid green light, and at the same time long streaks of white light appeared low down on the horizon, gradually stretching upwards to an altitude of about 45°.

"These rays of light wavered and at times moved across the sky in much the same manner as the rays of a searchlight.

"The whole sky at this time was tinted with a green glow, and though the moon did not rise for another three hours the visibility was such that pencilled figures on white paper could be easily discerned, though only occasionally could they be read.

"These white rays continued to appear until about 9 p.m., when they gradually faded in brilliance leaving only a green glow over the whole sky.

"This glow remained until about 11 p.m."

NOTE.—These observations spread over a period of about 16 hours on July 7th to 8th show that the influence responsible for the aurora affected both the northern and southern hemisphere.

CREPUSCULAR RAYS.

South Pacific Ocean.

THE following is an extract from the Meteorological Log of S.S. *Port Denison*, Captain J. FERRIS, Wellington to Montevideo. Observer, Mr. J. ROWLAND HILL, 3rd Officer.

"July 23rd, 1928. This morning a rather unusual manifestation of optical atmospheric phenomena attracted our attention, which I am here placing on record.

"Shortly before 8.0 a.m. to-day when in Latitude 51° 03′ S., Longitude 163° 55′ W., a remarkable formation of rays was observed on the S.W. horizon, radiating from a common centre at a point diametrically opposite the sun, which, obscured by a heavy bank of cloud, had attained an altitude of about 4° or 5°.

"The rays, which were faintly but clearly defined against the dark background of very distant cloud, were short and comparatively broad, radiating from a common centre considerably below the horizon, shortened by a low lying strata of comparatively close St.-Cu. superimposed about 3° or 4° above the horizon and lightened by the sun's rays.

"The base of the formation extended over an arc of the horizon of about 7° or 8°. The Barometer reading was 1010.6 mb. and the Hygrometer readings 37.5° F. and 35° F."

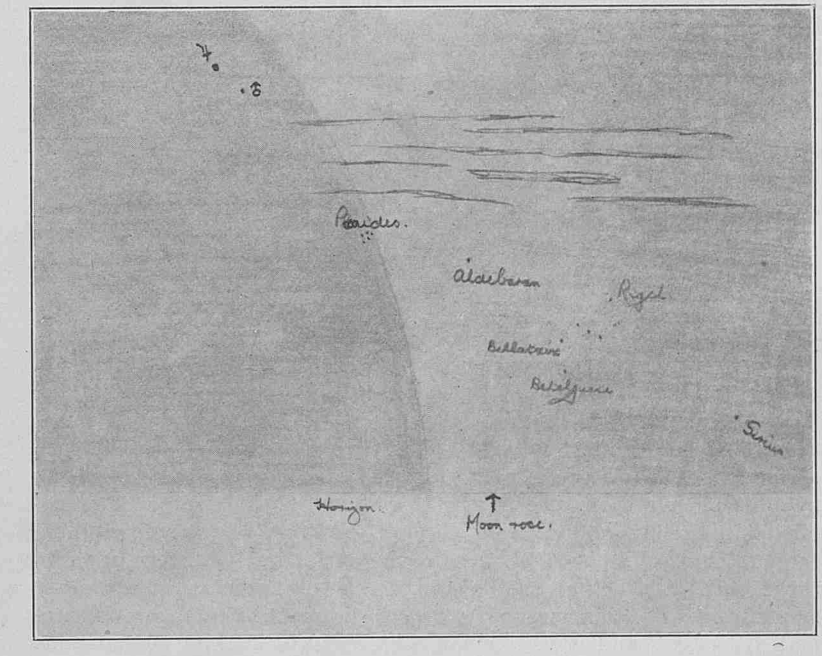
LUMINOUS ARC.

South Atlantic.

THE following is an extract from the Meteorological Log of S.S. *Hurunui*, Captain F. W. ROBINSON, Montevideo to Las Palmas. Observer, Mr. J. W. PRING, 3rd Officer.

"July 15th, 1928, Latitude 26° 50′ S., Longitude 44° 56′ W. At 4.45 a.m. A.T.S. (0740 G.M.T.) a peculiar arc of white light appeared in the sky, as shown in the illustration On the left-hand side was a clearly defined line between the lightened portion on the sky and the dark. On the right-hand side the light gradually merged into the dark. At 5.20 a.m. (0815 G.M.T.) the moon rose in position indicated, but the arc of light remained until gradually lost in the dawn. The only clouds in the vicinity of the light were a few Ci.-St. in long strips. The moon's age was 27.1 days. Sunrise was at 6.45 a.m. A.T.S."

NOTE.—This was probably the morning zodiacal light.



LUNAR HALO WITH DETACHED ARCS.

South Pacific.

THE following is an extract from the Meteorological Report of S.S. *Limerick*, Captain H. L. MOLYNEUX, Panama to Australia. Observer, Mr. F. J. SCHIBILD, 3rd Officer.

"July 1st, 1928, at 10.10 p.m. A.T.S. (100 G.M.T.) when in Latitude 22° 30′ S., Longitude 179° 51′ E. A halo formed round the moon, the moon being in the zenith. The sky was covered with Cirrus clouds which were moving from the S.W. and were in the shape of a fan radiating from the Northward. The radius of the halo was 22½° and the breadth subtended an angle of approximately ¾°. At 10.20 p.m. two arcs formed below the moon to the Northward, the apex of the higher arc being 28° above the horizon. At 10.40 p.m. the arcs disappeared and at 11.15 p.m. halo disappeared also. Barometer 29.94 in. Temperature, Air 70°, Water 75°. Wind, E.S.E. force 3."

WIRELESS PICTURE TRANSMISSION.

By A. J. Tabor.

A reference was made by the Marine Superintendent in the April, 1929, number of this Journal, page 73, in his notes on Marine Meteorology and the British Merchant Navy to "Radio Photography," and it may be of interest to have a brief outline of the recent developments and the methods adopted for picture transmission and reception by wireless.

Any useful accessory to the wireless equipment may find a convenient place on board ship and that the instrument under discussion will not be an exception is evidenced by the recent trials on board R.M.S. *Olympic* described further on.

Picture transmission by wire or wireless has from the earliest days of telegraphy received the attention of the inventor, yet it is only during the last few years that material advance has been made and success achieved.

This science should not be confused with Television which has as its object the art of transmitting moving pictures of happenings at a distant place by wire or wireless. It has been developed on very similar lines to still picture transmission, but as it is required to reproduce pictures at about a thousand or more times faster, some other channel of investigation appears necessary before television reaches the state of perfection attained by the present day picture transmission.

Improvements in the reproduction of news pictures, transmitted over considerable distances, have been noticeable in the daily press recently, yet the apparatus which produces these pictures has not been spontaneously created, but has been due to the gradual progress in other branches of science which have been adaptable to this subject.

Transmission.

To transmit a picture over a distance by wire or wireless it is necessary to piece up your subject into a large number of points, the more points the better, and to convey the density of each of the points, light or dark, to the distant receiving station where the picture is to be reassembled. Pictures of a moderate size may be sub-divided into squares measuring between 50 to 100 to the inch, as the smaller the square the better will be the definition of the finished image. By careful examination of the texture of most illustrated newspaper pictures, which are usually reproduced with about 50 dots to the inch, some idea may be gained of the resulting fineness of definition. To obtain this effect the picture to be transmitted may be photographed through what is known as a "line screen" having 50 to 100 lines to the inch, and transferred on to the face of a sheet of copper foil. Photographic enthusiasts are acquainted with this method under the name of the "gum bichromate process" and it is commonly used in the making of half-tone blocks for printing processes. This produces an image in the form of a gum deposit on the copper foil in which the white parts of the original picture consist of wide black lines almost joined together, while the dark portions are represented by narrow lines of gum deposit or actually bare copper.

The copper plate is clipped around a cylinder with the lines of the image parallel with the axis and is rotated in contact with a metal point in a similar manner to the record of the old phonograph. A lead screw which causes the metal contact point to traverse the cylinder may have a pitch of fifty to one hundred threads to the inch. As the lines of gum deposit, which possess fairly good insulating properties, pass under the contact needle, an electric current is interrupted and pulses of the order of 200 or more a second, but of varying duration due to the different thicknesses of the lines, are passed to the wireless transmitter which radiates wave trains of corresponding duration.

Other methods utilising an interrupted pencil of light in place of the metal stylus, mentioned above, have been evolved and in this case the copper foil is replaced by an ordinary black and white picture or a film on the cylinder. With the former, the beam of light is reflected or absorbed as it explores the picture and this varying density of light is focused on to a selenium or photo-electric cell which has the property of altering its electrical resistance when placed in a varying beam of light. Thus varying pulses of current are created and passed to the transmitter which deals with them in a similar manner to those received from the copper foil. The latter method, using the film, acts in the same way, with the exception that the light passes through the picture to the cell, instead of being reflected.

Several different applications of the above principal are in use. The light and cell may be (1) stationary, while the cylinder revolves and moves laterally; or (2) the light beam is made to revolve within the cylinder, while the cylinder moves across, see Figure 1; or (3) the light beam may be caused to move in both directions while the cylinder remains stationary.

Reception.

The receiver, tuned to collect the wave trains, converts them to pulses of current which exactly correspond in duration with those of the transmitter. These pulses are amplified and rectified when they are passed to the picture-receiving instrument.

This instrument is very similar to the picture transmitter, but around the cylinder in place of the copper foil or picture is placed, in the Fultograph system, a sheet of moistened paper treated with a starch-iodide solution which is traversed by a small platinum stylus, see Figure 2. Starch-iodide paper, better known as pole-finding paper, produces around the negative conductor a strong purple-blue coloration when a small current is applied to it. This purple-blue stain is produced on the revolving sheet of paper by the current delivered from the radio receiver and the density of the stain is governed by the current variations.

Other systems of reception using a ray of light and photographic sensitised film or paper in place of the stylus and starch-iodide paper are in use. In these methods the pencil of light is passed through a "Kerr cell" consisting of a system of Nicol prisms separated by a glass container filled with the colourless solution, nitrobenzine, across which an electric strain when exerted causes double

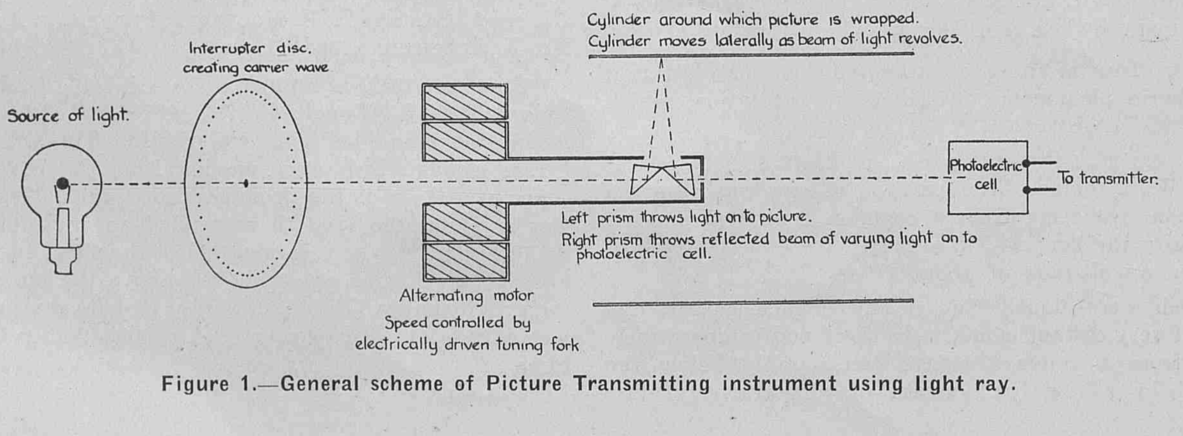
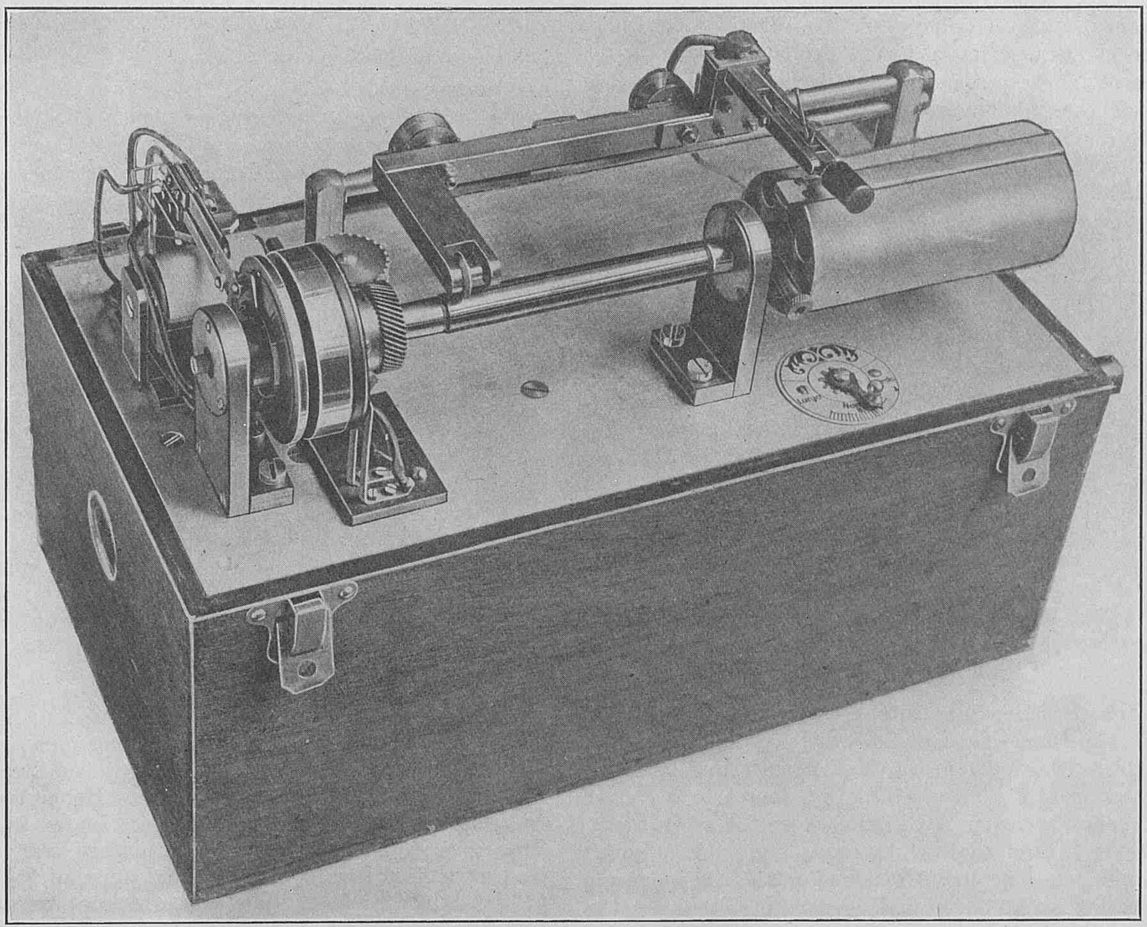

Cylinder around which picture is wrapped.
Cylinder moves laterally as beam of light revolves.
Interrupter disc. creating carrier wave
Source of light.
Photoelectric cell
To transmitter.
Left prism throws light onto picture.
Right prism throws reflected beam of varying light on to photoelectric cell.
Alternating motor
Speed controlled by electrically driven tuning fork

Figure 1.—General scheme of Picture Transmitting instrument using light ray.

refraction in the liquid. This acts as a regulating shutter, controlling the amount of light passed and is actuated by the varying current received. Several mechanically operated light shutters have been used but being more complicated and having moving parts are obviously less reliable. The ray is then focused on to the sensitised film or paper surrounding the drum of the instrument and after development the picture is obtained, see Figure 3.

Synchronisation.

It will be obvious that to reassemble the picture at the receiving end, the cylinder on which the paper is wrapped must be perfectly synchronised with that of the transmitting instrument. The extent of synchrony required is worth considering. Supposing one cylinder to take one second to rotate and the other 1.005 seconds; a difference of only ½ per cent., then, assuming a width of 4 inches, by the time the traversing of the image is complete there would be a displacement of 50 by 4 by .005 second or one second, equal to a complete revolution behind time. As a result instead of the image forming correctly it would be spiral, like a screw thread around the cylinder and devoid of identity. Even one part in a thousand too fast or too slow destroys the detail of the picture.



[Reproduced by kind permission of the "Wireless World and Radio Review."]

Figure 2.—Photograph of the Fultograph Picture Receiving instrument showing the magnetic clutch, cams and contacts on the left; the lead screw which carries the stylus across the paper is seen in the centre; while on the right is seen the cylinder which carries the starch-iodide paper upon which the picture is reproduced.

Several methods of obtaining synchronisation between the cylinder of the transmitter and that of the receiver have been evolved. Most alternating motors will run at a constant speed if supplied with current of the same frequency and this fact has been made use of. All that is required, therefore, is a source of alternating current of the same frequency at both transmitter and receiver. This is created by an electrically driven vibrating tuning fork. To keep the vibrations as constant as possible the fork is kept at a constant temperature by a thermostat.

A very interesting electrical mechanism which might be briefly described as a combined motor and governor, invented by Professor A. E. Conrady and produced by W. Watson, runs at a constant speed with an accuracy of not less than one point in ten thousand has been used with success.

A method successfully developed by Mr. T. Thorp-Baker employs pendulums at sending and receiving ends to check and release the cylinder at each revolution. This method would obviously be unsatisfactory at sea on account of the motion of the ship. The method adopted by Captain O. Fulton is somewhat similar to Mr. Thorp-Baker's idea at the receiving end in so much as the cylinder is checked at each revolution. This checking action is achieved by the transmission once each revolution of the sending cylinder, of a short signal, sent out in the interval which occurs in the picture signal as the stylus passes over the join in the paper. When this signal is picked up by the receiver it works a relay which in turn releases a catch from the cylinder and energises a magnetic clutch connecting the cylinder to the driving mechanism. The cylinder therefore rotates and the varying pulses of current are passed through the stylus to the prepared paper as previously explained. When the stylus again reaches the join in the paper cams come into operation which cause the catch to fall against the cylinder and on encountering a gap, falls into position, arrests the cylinder and in so doing breaks the circuit which energises the magnetic clutch. With the clutch thus released the clockwork continues to rotate at its constant speed. Therefore once each revolution the receiver cylinder, which is running slightly faster than that of the transmitter, is briefly held and released again by the signal sent out by the transmitter.

An experimental transmission of pictures is now being carried out from the British Broadcasting Corporation's station at Daventry, **5XX**, using the Fultograph method. The copper foil system was used at first but has been replaced by the light cell apparatus resulting in sharper definition. The same system was recently used with success on board R.M.S. *Olympic* during the middle of last December. Arrangements were made for press pictures to be

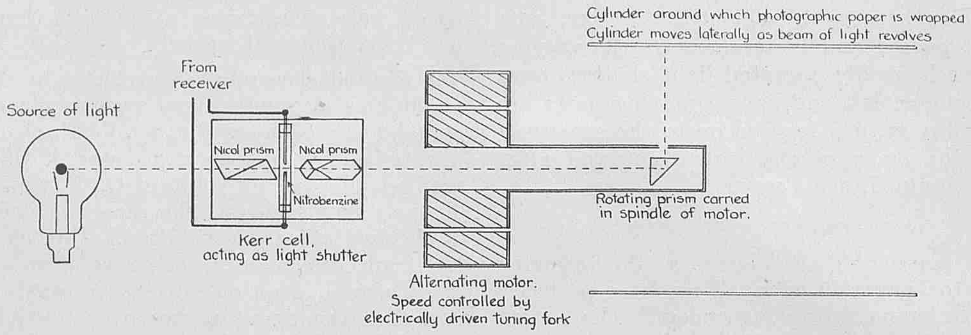

Cylinder around which photographic paper is wrapped
Cylinder moves laterally as beam of light revolves
From receiver
Source of light
Nicol prism
Nicol prism
Nitrobenzine
Kerr cell, acting as light shutter
Rotating prism carried in spindle of motor.
Alternating motor. Speed controlled by electrically driven tuning fork

Figure 3.—General scheme of Picture Receiving instrument using light ray.

transmitted each morning from Rugby W/T for the six days of the vessel's outward passage. The transmitter employed was that used normally for the transatlantic telephone service. On the first day six pictures were received without a hitch, printing blocks made, and a large number of illustrated news sheets printed off creating much surprise among the passengers at breakfast time. Equally successful results were obtained on the next four days, the range then reaching 2,225 miles. On the last day when 2,800 miles distant, reception was obtained although the image bore marks of static. Tests have just been completed whereby facsimile documents, &c., can be flashed across the Atlantic, a sheet of typed matter which can contain 1,500 words, measuring 7 in. by 9 in., taking only seven minutes to complete. This service utilises the light and sensitive paper method similar to that illustrated in Figures 1 and 3 and is said to give remarkable clarity.

An interesting and valuable application of the wireless picture service was recently shown when the Silver Line motor ship *Silvermaple*, bound for New York, was disabled in the Atlantic, when 500 miles from Bermuda, her rudder stock having been fractured. Sketches were made from the original plans in this country and transmitted by wireless to New York where the new rudder stock was made and shipped to Bermuda. This effected a saving of at least a week.

A moment's reflection will show that this science should have a large field of utility both at sea and ashore in the near future, and as valve receiving equipment is steadily increasing on board ship, the addition of the small receiving instrument should be a simple matter. It may be the means of relieving some of the present congestion in wireless traffic and also be a strong rival to the high speed telegraphic instrument since, as mentioned above, it is able to transmit at over 200 words per minute with the advantage of reproducing an absolutely true copy of the original.

From a meteorological standpoint, it may be possible in the future to broadcast Weather Charts for the use of shipping, thus saving time not only in transmission but also saving work on board ship by the officers in decoding and plotting the information, and thus making the initial cost of installing a picture receiver worth while for the practical purposes of navigation.

SOUND TRANSMISSION AND METEOROLOGICAL CONDITIONS.

Prepared in the Marine Division by E. W. Barlow, Senior Professional Assistant.

As was stated in the Marine Superintendent's article "Special Observations, Tests and Investigations and their Influence on the Work" in Marine Observer, Volume VI, No. 65, information as to the range and the vagaries of the audibility of sound in air over the sea in various types of weather is of importance for safe navigation. It was further remarked that while there had been a great development in recent years of devices utilising the transmission of sound through water, such as submarine sound signalling, the hydrophone and echo sounding gear, much remains to be learnt of the transmission of sound through air under natural conditions. The purpose of the present article is to present in a simple form the knowledge we already have in regard to this subject. It will be seen in due course that the transmission and audibility of sound in natural conditions, as opposed to the artificial restrictions of experiments in the laboratory, are very complex and depend upon a number of factors. In this article we shall therefore take into account not only some of the known laws of physics but also such investigations as have already been made in natural conditions. The latter are, however, few in number.

Wave-Motion.—Before dealing with such practical knowledge as we have it is desirable to give a short account of the nature of sound in so far as it is necessary for our present purpose. Sound is propagated as a wave-motion of material particles. The sounds we normally hear in daily life come to us as wave-motions of the earth's atmosphere, but sound may also be propagated as wave-motion in liquid or solid matter. It is easy to prove that sound requires material substance for its transmission, and there is a well-known experiment in which the bell of an alarm-clock placed within a glass vessel exhausted of air can be seen to strike but cannot be heard. Herein lies the essential difference between sound and those waves familiar to us in the form of light, heat and electro-magnetic waves which are quite independent of material substance for their propagation and which are usually referred to as being wave-motions in the ether of space. Hence light, heat, &c., reach us from the Sun and other celestial bodies while sound does not. This is a fortunate provision of nature, otherwise it is probable that we should live in the continual noise of the storms or explosions of the Sun's surface. We also see the reason why the speed of sound, 1,100 feet per second in air, is enormously less than the speed of ether waves, in round numbers 186,000 miles per second, since it depends on the comparatively slow movements of the molecules of material substances.

A source of sound is a source of energy which sets air in vibratory motion in its immediate vicinity. The disturbance immediately spreads outwards equally in all directions as a series of concentric shells composed of alternate condensations and rarefactions of the previously undisturbed air. If the source continues to operate, the disturbed air at a given moment will have a spherical form, a plane section through the centre of which is shown diagrammatically in Figure 1. It is to be understood that we are assuming that no obstacles exist in the path of the waves and that the air is calm and is uniform in temperature and other conditions, an ideal state almost impossible to find in natural conditions. In the diagram it is also assumed that the source of sound is quite pure, giving a musical tone of one definite wave-length. The wave-length is the distance, measured along a radius, from any region of maximum condensation to the next similar region. The energy of the waves, by making the drums of the ears vibrate, convey to us that sensation which we call sound. The wave-motion is propagated by the molecules of the air, each one of which hands on, by collision with its neighbours, a part of the original energy of the source. If we

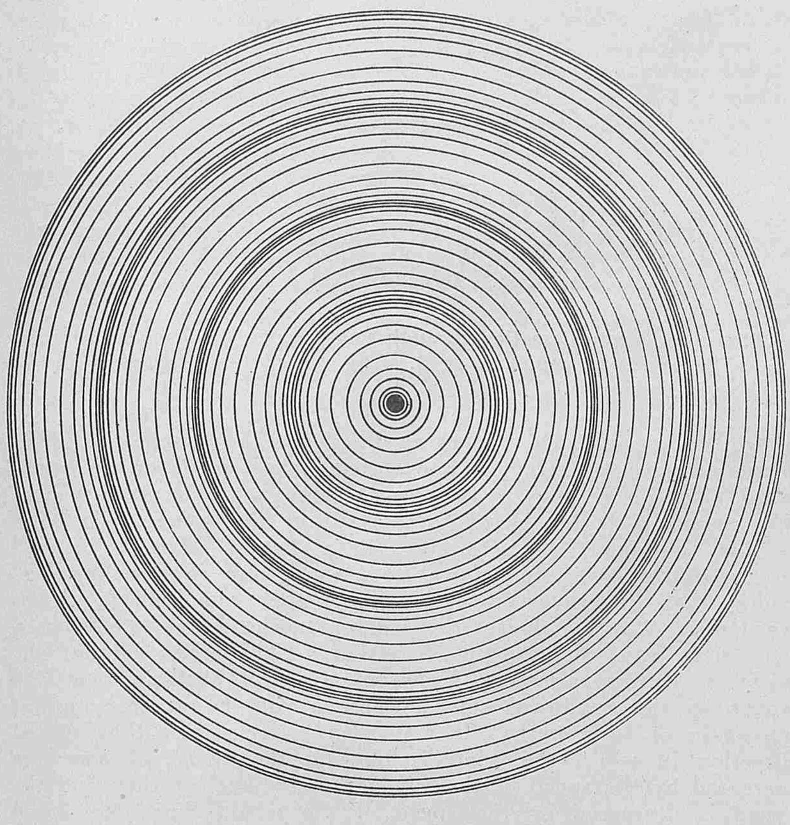


Figure 1.—A plane section of a spherical volume of air containing undistorted sound waves. The source of sound is at the centre.

think of a train of goods trucks with their spring buffers, standing without an engine, and imagine an impulse given to the end truck by the arrival of an engine we shall get an excellent illustration of the propagation of sound. Each truck in turn passes on the impulse to the next one by moving towards it with a compression of the buffers; it then moves back again to its original position. Thus while each truck has only moved a short distance and back again a condition of compression or condensation has travelled along the entire train. Furthermore the speed of transmission of the condensation is considerably more than the speed of the individual trucks. Precisely the same thing occurs in the case of sound except that conditions alternately of condensation and rarefaction are transmitted. Everyone is familiar with the outward spreading circular waves produced when a stone is dropped into a still pond. It is interesting to note the resemblances and differences between these water waves and sound waves. The water waves are circles, not spheres, as the motion takes place in a horizontal plane. They are propagated outwards by the motion of each water particle forward and backward along a radius just as happens with the air particles in sound waves through the atmosphere. The fact that there is no continuous outward motion of the water as a whole is well known to everyone from watching the behaviour of any floating object as the wave condition passes it. In the water waves there is also an up and down motion, which causes the familiar ripples, at right angles to the radius. Technically, therefore, these water waves would be described as both longitudinal and transverse, while sound waves are longitudinal only. In light and other ether waves the vibration is transverse.

The intensity of a sound at a given place depends on the length of the forward or backward excursion of the air molecules from their mean positions, or as it is called, the amplitude of the wave. The amplitude of the transverse vibration of a water wave is the height of the crest of the wave above that of the undisturbed water, or the depth of the trough below that level. The amplitude, and therefore the loudness with which we hear the sound, depends on the degree of the original vibration of air by the source of energy. Again assuming the ideal state of calm, uniform air the law of decrease of intensity of sound with increasing distance from the source is as follows:—At double the distance the intensity is reduced to one-quarter, at treble the distance to one-ninth, and so on. In other words the intensity is inversely proportional to the square of the distance, and this well-known law of physics applies also to light or any other kind of energy transmitted by regular wave-motion. As each of the concentric shells representing successive wave-lengths is larger than the preceding one it is easily seen that the decrease of intensity with distance from the source must be a fairly rapid process, the original energy being spread over a rapidly increasing volume of air, and it is mainly for this reason that we cease to hear the sound at a sufficient distance. The waves, however, do not go on for ever and the energy originally imparted to them is finally dissipated, becoming transformed into heat which raises the temperature of the air and the ground to a quite imperceptible extent.

Pitch.—The different sensations produced by notes of different pitches is one of those things which is well known to everyone but cannot be defined. The pitch of a note depends only on the frequency with which the vibrations reach the ear. Thus the frequency of middle C on a piano is about 500 vibrations per second and therefore the period of each vibration is 1/500th second. If we listen to this note for the duration of one second 500 vibrations will be received by the ear, and as the sound waves in air will have travelled 1,100 feet during that time it is easy to see that the wave-length of middle C must be 1,100 feet/500, that is a little over 2 feet. The limits of audibility vary to some extent in different ears, but normally vibrations of frequencies lying between 30 and 4,000 are audible as notes of recognisable pitch. This range corresponds to all wave-lengths from about 37 feet to 3 inches. Sounds can be heard outside these limits, particularly above the upper limit, up to a frequency of from 10,000 to 20,000. Modern marine sound-producing devices, as for example the diaphone, are designed to produce a number of notes of different pitches at the same time because under difficult conditions for sound transmission it is possible that a note of high pitch may be received when those of lower pitch are not, or vice versa.

In the practical consideration of the transmission of sound at sea the vital factors are those which weaken the intensity of sound waves or which deflect them away from a place at which audibility is normally expected. Before dealing with these factors it is however desirable to say a few words about the speed of sound. Sound of any pitch travels at precisely the same rate and hence, no matter what combination of pitches is emitted by a sound-producing device, the various notes all arrive at any given distance simultaneously. If this were not so the music from a band playing in the open would be a mere jumble of sound when heard from a distance. It must be clearly understood that this only means that when sounds of two or more pitches are heard together they have reached the hearer in exactly the same time; it does not imply that the meteorological conditions may not be such as to render one or more of the notes inaudible at a given distance while the remainder are transmitted. If the speed of sound were affected to any great extent by meteorological conditions this would become a factor of practical importance, but this is not the case. Variations of atmospheric pressure have no effect upon it, but it is affected slightly by variations of temperature and humidity. The speed increases with rise of temperature and also with increase of absolute humidity. Thus, at a temperature of 32° F. the speed is approximately 1,089 feet per second, at 60° F., 1,145 feet per second, and at 90° F., 1,205 feet per second. It may be remarked, incidentally, that the speed of sound in water is much greater than in air and is greater still in solids. The speed of sound in air is slightly greater for very loud sounds, such as a gun firing, than for fainter sounds, but this again is of no practical importance for our present purpose.

A knowledge of the speed of sound may be useful on occasion. Thus, the distance of a thunderstorm may be approximately determined in miles by timing carefully the interval between a flash of lightning and its accompanying peal of thunder and dividing the number of seconds by five. Also sound echoes are easily formed by reflection of the sound waves from a solid mass such as a cliff. If the interval between the sound produced on board the ship and its return as an echo is noted and multiplied by 1,100 feet, the result is twice the distance of the ship from the coast. The passage of the light from the flash of lightning or that from the emission of steam in the experiments described by the Marine Superintendent in the article above referred to is quite instantaneous for practical purposes, but a source of error is introduced in such cases because of the fact that the response of the eye and ear to impressions of light and sound is not equally rapid. The difference of response should not, however, exceed a small fraction of a second.

General Remarks on Meteorological Conditions.—In giving the above account of the nature of sound waves we assumed that they were undisturbed by meteorological or other special conditions. We have now to state what we at present know about the disturbance of sound waves in air in natural conditions. It must be understood that natural conditions are usually complex and are often so in the highest degree and it would be beyond the power of anyone to set out all possible variations of the actual paths of waves of sound. Not only have the conditions near the ground to be taken into account, but also those in the upper air, in some cases to a very great height. Thus every change in speed or direction of wind with height in the upper air will affect the path of sound and so will every change of temperature or humidity. All that can be done in the present article is to consider the effect of wind, temperature, &c., separately in the form of general principles and to give simple illustrations, remembering that in nature the various factors are acting together at the same time. Also, the further we are from the source of the sound the greater the probability that the meteorological conditions along the path of the sound will be variable. The transmission of sound in air is a more complex problem than its transmission in water.

In the years 1921-22 Mr. E. S. Player carried out a series of experiments on the audibility of the sirens of the North Goodwin and other neighbouring lightships. He was stationed at Joss Gap, near the North Foreland, and the sound was received by electrical and photographical recording instruments as well as by the ear. The Elder Brethren of Trinity House granted the privilege of special blasts on certain days of the week so that the transmission of sound could be studied in different types of weather. The result of one set of observations is given in Table I and is very interesting as showing the great variation of the intensity of the sound received in successive minutes. The lightship bore 122° at a distance of 7 miles and the wind was 215°, 12 m.p.h. The galvanometer deflections for 44 blasts with one minute between each are shown in the table, the figure 0 indicating inaudibility.

Table I.

Variations in intensity of Sound received from the Siren of the North Goodwin Light-Vessel, March 12th, 1921, 3.50 p.m. to 4.34 p.m. (B.S.T.).

Blast.	Galvanometer Deflection.	Blast.	Galvanometer Deflection.
1	1	19	2
2	4	20–28	0
3	1	29	5
4	0	30	9
5	0	31	3
6	5	32	9
7	1	33	3
8	1	34	3
9	6	35	5
10	1	36	3
11	1	37	7
12	1	38	2
13	4	39	1
14	3	40	0
15	3	41	8
16	1	42	1
17	3	43	1
18	1	44	2

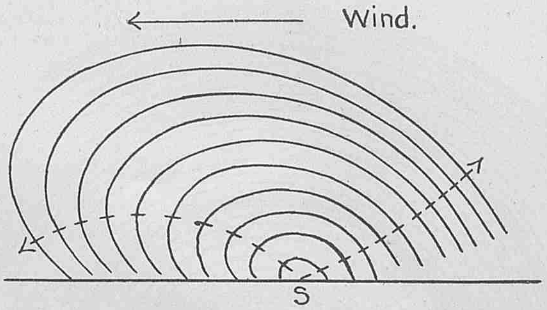


Figure 2.—Vertical section through sound waves distorted by wind. The source of sound is at S. The dotted lines represent two rays of sound.

The Effect of Wind on Sound Transmission.—The effect of wind is to distort the spherical sound waves as is shown diagrammatically in Figure 2, where the source of sound is at S and the wind direction is as shown by the arrow. We are considering here the wind near the ground, which increases in velocity with height above the ground. On the leeward side of the source the sound waves advance more rapidly above than below, while on the windward side the reverse is the case. There are thus two reasons why sound is better heard to leeward of the source. The first is that the sound waves received at a distant point to leeward of the source have come down from above and so have lost less energy than the waves travelling nearer the ground on the windward side. Also, as shown in the diagram, the waves to windward very soon leave the ground altogether. The second is that the waves to leeward are more likely to pass over obstacles than the waves on the windward side on account of the greater upward curvature of their paths. It may also be remarked that in the direction in which the wind is blowing the speed of sound is increased by the speed of the wind; directly against the wind the speed is decreased by the speed of the wind. Since the speed of sound is about 650 knots it is obvious that only very strong winds have much effect on its speed. Pitch is not affected by the speed of the wind. From the effect of wind in distorting sound waves, it may easily happen that a sound, such as a gun firing, made at a place A, is heard at a place B to leeward of A, while the sound of a similar gun fired at B is quite inaudible at A. The statement that sound is heard better to leeward than to windward only applies on or close above the land or sea surface; at greater heights the sound will be better heard to windward. Thus, in a ship to windward of a source of sound, the sound would be better heard at the masthead than on deck.

There are other wind effects. Sound waves can be refracted and reflected like light waves. In considering the paths of sound in these cases it is easier to think of rays of sound rather than the waves themselves. Thus, with our original undisturbed spherical waves, any radius of the sphere represents a ray of sound because sound travels equally far along any radius in a given time. In the diagram of waves distorted by wind, shown in Figure 2, two of the sound rays are indicated by dotted lines showing the downward curve of the path of sound to leeward and the upward curve to windward. Now let us suppose that the wind near the surface is calm or light and that the rays of sound proceeding upwards meet a definite wind current in the upper air. In such a case the sound ray is refracted, continuing upward but making a smaller angle with the horizontal. If, in the upper air, the sound ray suddenly enters a region of less wind it is also refracted, continuing upward but making a larger angle with the horizontal. If the sound rays pass into a region where wind speed is gradually increasing with height the result is similar to that of Figure 2, where the rays are bent successively downward to leeward and upward to windward. If the wind speed gradually decreases with height the paths would curve upward to leeward and downward to windward. Thus endless variations of the path are possible with successive wind changes in the upper air. Also, whenever there is an abrupt change of wind and refraction occurs, a small proportion of sound will be reflected downwards towards the ground. In certain conditions the whole of the sound will be reflected downward by total reflection at a stratum where the wind speed abruptly increases.

These effects of wind provide one means by which the phenomenon of zones of silence may be explained. It has long been known that sound, for example that of gunfire, may be heard up to a distance from the source, then be inaudible for a further distance and heard again at still greater distances. Maps have been constructed from a number of observations of a particular sound which show very clearly these more or less irregularly shaped areas of inaudibility, and the great explosions of surplus ammunition dumps in France and elsewhere since the war have been utilised in studying the subject. It is easy to see that the total reflection of sound from a height in the air could direct a ray downwards which might ultimately reach the land or sea surface. When this is the case it may give rise to audibility at a point beyond which the direct rays from the source, travelling more or less horizontally, could affect the ear. The longer path is the easier one and the sound therefore arrives at the ground with less loss of energy.

The Effect of Temperature on Sound Transmission.—Generally speaking, temperature decreases with height above the ground and this results in the upward deflection of sound rays. Hence the normal state of affairs is for sound to be heard at greater distances upward than horizontally along the ground. Thus FLAMMARION in a balloon in the neighbourhood of Paris heard the chirping of crickets at a height of 2,620 feet and the croaking of frogs at 2,950 feet. When there is a temperature inversion, that is when temperature increases with height for some distance above the ground, sound is deflected downwards, and as on these occasions there is usually little or no wind, conditions are very favourable for audibility in all directions along the sea or land surface. When different air currents are superimposed there may be considerable sudden changes in temperature with height. In such cases refraction occurs as in the case of wind currents, and it is quite possible for total reflection downwards to occur in suitable circumstances. Generally speaking, variations of wind speed and variations of temperature are acting at the same time in the deflection of sound rays, but they may be working together or in opposition. The irregularities introduced by temperature differences may therefore also have their place in the explanation of zones of silence. Recent research into the subject of meteors goes to show that at a very great height in the earth's atmosphere, about 40 miles, there is a large and rather sudden rise of temperature. It has been pointed out by Dr. WHIPPLE that reflection of sound waves from this layer would give a zone of audibility on the earth's surface whose nearest point to the source would be about 90 miles. Such a zone was actually observed on the occasion of the Oldbroek Explosion of 28th October, 1922.

The Effect of Humidity and Fog on Sound Transmission.—PLAYER'S observations of the sirens of light-vessels, previously referred to, show that humidity has a definite effect on the distance over which sounds can be heard. Thus on 21st April, 1921, with little variation of temperature during the day, variations in audibility followed those of humidity almost exactly. Audibility decreases with lowered humidity and increases with rising humidity. On this day the Tongue Light-Vessel's fog signal, distant 9 miles, was inaudible with relative humidity 70 per cent. or less, faintly heard with humidity 70 per cent. to 75 per cent., moderate from 75 per cent. to 80 per cent. and loud above 80 per cent. Effects of refraction and reflection will also be obtained if the sound rays encounter strata of abrupt or gradual change of humidity, and the same applies to nearly horizontal waves which meet such changes of humidity near the sea or land surface at varying distances from the source. The path of the sound rays therefore depends on the combined effects of strata or patches of different wind speed, temperature and humidity. As it is known that the humidity of the air may on certain occasions change appreciably almost from minute to minute without change in temperature or apparent change in other conditions, it is probable that the rapid variations of audibility in TABLE I are mainly due to humidity changes.

It is well-known to navigators that in foggy conditions at sea the sound signals are unreliable and while they may be heard further from the source are not always heard at shorter distances. It is also well-known that sounds normally inaudible may be heard in foggy weather and that frequently the presence of fog definitely increases audibility. These statements appear at first sight contradictory, but there is quite a simple explanation. If the source of sound and the observer are in a continuous stratum of fog audibility will be increased. The presence of the temperature inversion normally associated with land or sea fog refracts the paths of the rays downwards. Also the high humidity, as we saw above, is advantageous, and finally the almost complete absence of wind (which applies, however, more to land than to sea fog) allows the sound to spread equally well in all directions. If, however, the fog is patchy the conditions are quite different. Suppose the source of sound and the observer are both in fog with clear air in between. There may then be large reflections of sound at the two surfaces between the fog and clear air so that little or no sound comes through to the observer. The same applies if the source and the observer are both in clear air with a fog bank between them. Even in stretches of continuous fog there are usually patches of variable density and these may cause a loss of sound which may wholly or partially neutralise the advantages of the fog to audibility.

Audibility on "Oppressive Days."—On what are usually called "oppressive days", with little or no wind, high shade temperature and a cloudless sky with a slight but definite haze which slightly dims the sun, PLAYER found that the worst conditions prevailed for audibility along the land or sea surface, although sounds coming downward as from an aeroplane were transmitted well. This type of weather does not necessarily imply thundery conditions, and it has been noticed that exceptional audibility may precede a thunderstorm. Rain, hail and snow appear to have little or no effect on audibility.

THE MONSOONS.

III.—Theory of the Monsoon. The Lesser Monsoons.

IN the first article of this series we saw how the theory of the Monsoon has remained essentially unchanged since the time of HALLEY. The S.W. Monsoon has throughout been considered as a part of the circulation round an area of low pressure situated over the heated interior of the continent of Asia in summer, the N.E. Monsoon being similarly associated with a high-pressure area over the cold continent during the winter. In the account of the general circulation of the atmosphere which formed the concluding article of the series on the Trade Winds it was, however, shown that all processes of atmospheric circulation are much more complex than was formerly supposed. It is therefore necessary to give a summary of the theory of the Monsoon in the form in which it is held by meteorologists at the present time. The most recent and the most complete account of the theory of the S.W. Monsoon of the Indian Ocean is that given by Dr. G. C. SIMPSON, C.B.E., F.R.S., the Director of the Meteorological Office, in the Quarterly Journal of the Royal Meteorological Society, Volume XLVII, No. 199, July, 1921. The remarks which follow on the S.W. Monsoon are summarised from this paper. Dr. SIMPSON'S paper also contains a complete theory of the details of Indian monsoon rainfall in the various parts of the peninsula, but this will be only very briefly referred to here as lying outside our immediate subject. After a short account of the N.E. and other Monsoons of the Asiatic region, the upper winds over the Monsoons and their relation to the general circulation will be described, so far as these are at present known.

The S.W. Monsoon, Indian Ocean.—The primary cause of this Monsoon is, as HALLEY stated, the difference of temperature over land and sea. The relatively high temperature over the land during the northern summer tends to lower the atmospheric pressure over it. In consequence of this, air motion is set up and is acted upon by the earth's rotation, as in the case of any low-pressure system. The air motion, however, modifies the original distribution of temperature, and this in turn modifies the original pressure distribution, giving as an actual result a huge closed low-pressure system covering the whole of Asia and Northern Africa, with a small area of lowest pressure over North-West India. The average pressure for the month of July is shown in FIGURE 1, which, together with FIGURE 2, are portions of the world pressure charts published in the MARINE OBSERVER,

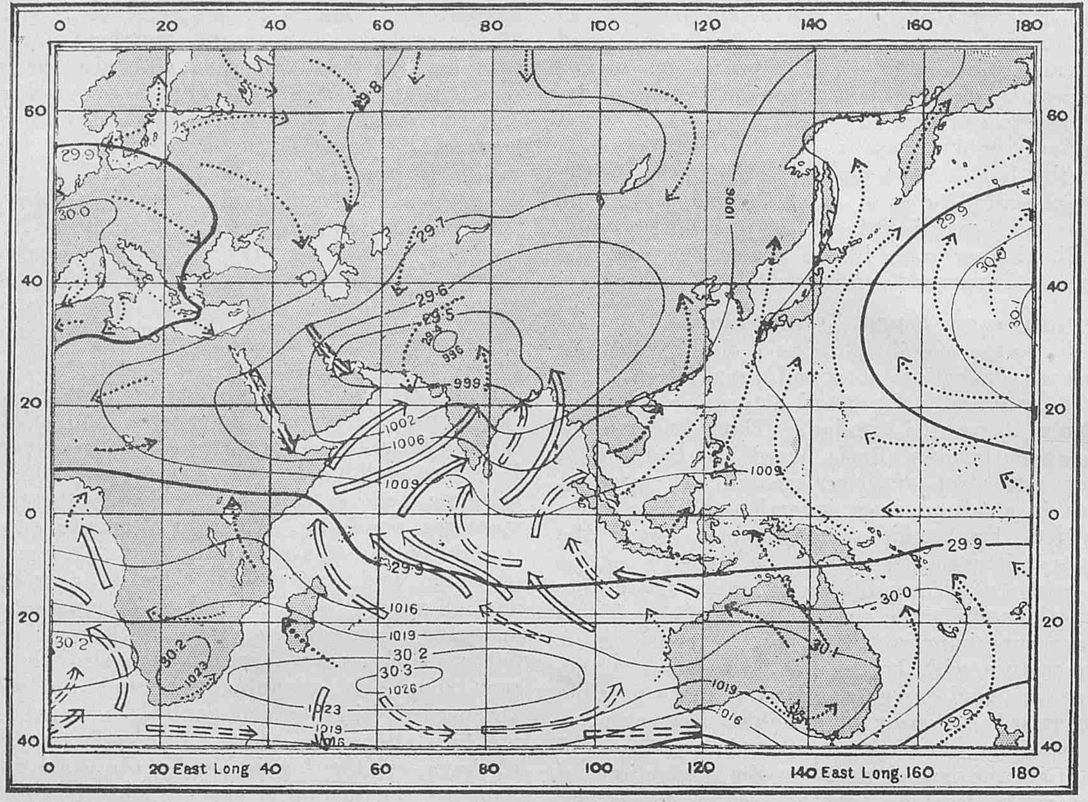

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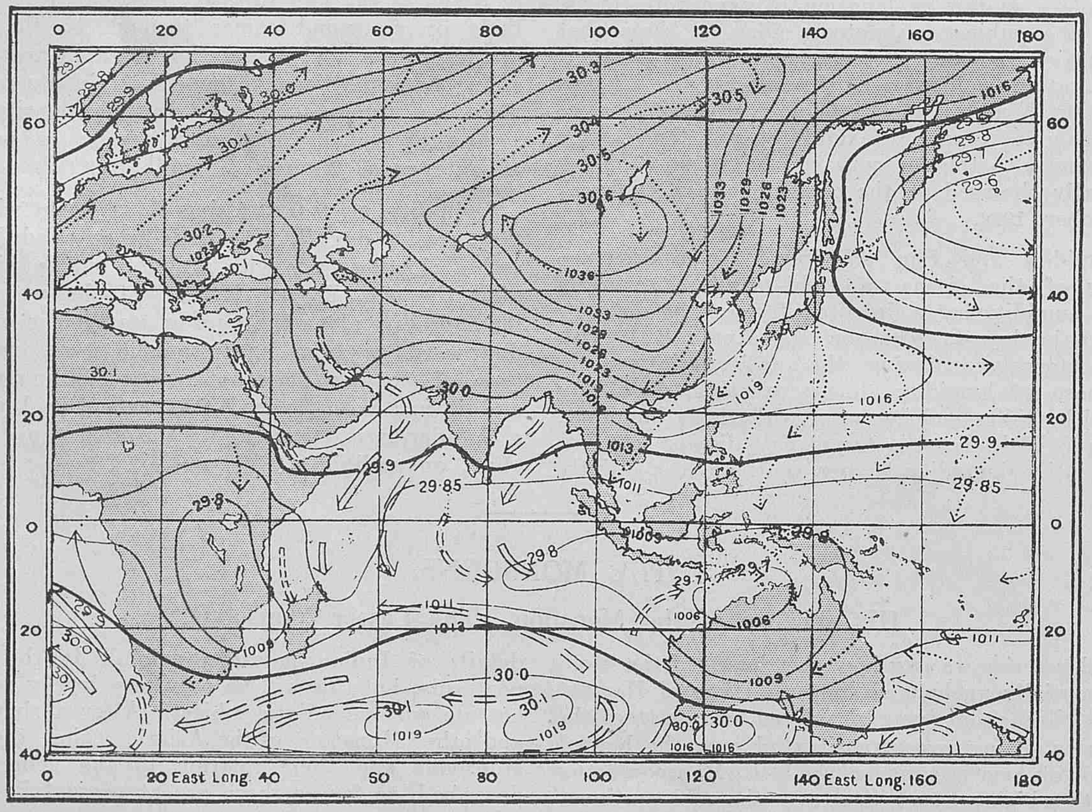
Figure 1.—Average Pressure and Wind—July.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1011

Figure 2.—Average Pressure and Wind—January.

Volume IV, No. 42, June, 1927. It should be noted that the actual pressure system bears no close relationship to the actual temperature in the different parts of the area. As the North Indian Ocean, including the Arabian Sea and Bay of Bengal, is situated to the south of the low-pressure area, the air over the ocean blows in from the S.W. to take its part in the general circulatory motion. South of Latitude 20° S. is situated the central area of the permanent anticyclone of the South Indian Ocean which gives the S.E. Trade Winds of that Ocean. When the pressure over the Asiatic continent falls during the northern summer the pressure in the whole anticyclonic area rises slightly, there being a difference of about 7 mb. (0.2 in.) between its highest pressure in January and July. There is thus a gradient of pressure right across the equator in the northern summer from 1,026 mb. (30.3 in.) in Latitude 30° S. to 996 mb. (29.4 in.) in Latitude 30° N. As a result of the intensification of pressure south of the equator the S.E. Trades extend as far as the equator during the northern summer. At the equator the air thus brought from the S.E. is caught up in the circulation around the Asiatic low-pressure system so that the same air continues to move north of the equator in a north-easterly direction, thus forming the S.W. Monsoon. The S.W. Monsoon when it reaches India is thus composed of air which has travelled for 4,000 miles over the ocean and is therefore highly charged with water-vapour. This in itself would not produce the intense Monsoon rainfall of India, but Dr. Simpson has shown that the configuration of the Himalayas and other Indian mountain ranges is such that the air is caught in a kind of trap, out of which there is no escape except by rising. The forced rising of humid air fully explains the heavy rainfall.

It might be supposed that the Indian Monsoon would set in in May, for the pressure distribution is very similar to that of June and July, and the temperatures over India are higher in May than in the later months. A careful examination shows, however, that the Asiatic low-pressure system has not reached its greatest intensity and that the spread of the southern anticyclone has not advanced sufficiently to bring the flow of Trade Wind air across the equator. Furthermore, the shape of the low-pressure isobars is not the same as in later months; they run more to the north and south over the Arabian Sea and India, thus giving the light northerly or north-westerly winds which prevail over most of the Arabian Sea in April and May. It is only when the pressure changes have proceeded further and air passes directly from the S.E. Trade Wind into the Asiatic low-pressure system that the strength of the Monsoon is felt in the North Indian Ocean, and that enough damp air reaches India to cause sufficient cloud and rain to overcome the high temperature. The lower temperature of India in June and July is the result of the Monsoon rainfall. This explanation of why the Monsoon is not established in May is borne out by a comparison of observed mean humidities and wind speeds at stations on the west coast of India for May and July. The wind speed in May is only half that of July, and the humidity is appreciably less. Although the conditions in May are not such as to establish the Monsoon in that month, they are very favourable to the formation of thunderstorms, which are specially frequent in Burma, Assam and Bengal. Also during breaks in the Monsoon in later months the inflow of moist air, while reduced, is not entirely cut off, and this, in conjunction with the resulting temporary rise of temperature over the land, causes thunderstorms during these periods.

The processes which give rise to the Monsoon are thus seen to be complex, with a number of inter-related factors; any disturbance in one factor affects all the others, and it is impossible to state which is cause and which is effect. The variations in the S.W. Monsoon from year to year are therefore the result of the increased or decreased potency of one or more of these factors, which upsets the balance of the whole.

The N.E. and N.W. Monsoons.—The low temperature of the interior of Asia in winter is the prime cause of the large anticyclone which covers the whole of the continent during that season. The average run of the isobars for January is shown approximately in Figure 2. The region of maximum pressure lies much more centrally in the continent than does the low-pressure area of summer. The gradient of pressure on the south of the centre is seen to be relatively steep and is sufficient to account for the outflow of air over the North Indian Ocean which constitutes the N.E. Monsoon. This air will be comparatively cold and dry.

The island-continent of Australia has seasonal variations of pressure which, though less intense, are in other respects similar to those of Asia. Lying south of the equator, the low-pressure system exists during the southern summer, and is shown in Figure 2, while the high-pressure system of the southern winter is shown in Figure 1. Hence arise the monsoonal Australian winds which are referred to later in this article. It therefore happens that the low-pressure system of Australia is at its greatest intensity at the same time that the high-pressure system of Asia is at its maximum. Furthermore, while the centre of low pressure covers a comparatively small area of the northern Australian coast and its adjacent waters, the system as a whole is much elongated in an east-west direction. Thus, while the centre of the system is represented by the 1,006 mb. isobar (29.7 in.), the 1,009 mb. isobar (29.8 in.) reaches from New Guinea nearly to the central longitudes of the Indian Ocean. Just in the same way that there is a clear run through for the air from the high-pressure area of the S.E. Trade Wind to the low-pressure of Southern Asia during the northern summer, so there is a clear run through for the air flowing out of the Asiatic high-pressure area to the low pressure of Australia during the northern winter. This provides a satisfactory explanation of the N.W. Monsoon of the Indian Ocean and East Indies. The following points should be noted:—The N.W. Monsoon is experienced almost wholly to the south of the equator, thus conforming with southern hemisphere cyclonic circulation. This Monsoon is shown by actual observation to be strongest during December, January and February, the low-pressure area being most intense in January. Finally, the N.W. Monsoon is as a whole weak and fitful, which is in accordance with the gentleness of the pressure gradient from Northern Australia to the equator in the central longitudes of the Indian Ocean. The squally and wet weather experienced in the N.W. Monsoon area is due to the meeting of the N.W. Monsoon and the S.E. Trade Wind in the neighbourhood of Latitude 10° S.

The Monsoons of the China Seas and Eastern Mediterranean.—The Asiatic pressure distributions are of such extent that winds dependent on them are experienced from the China Seas to the extreme east of the Mediterranean. The former are the N.E. and S.W. Monsoons of the China Seas. The relatively steep pressure gradient, which as stated above is found to the south of the centre of Asiatic high pressure in winter, is also continued, not quite so steeply, over the area to the east of the centre, including China and the China Seas, as shown in Figure 2. The actual pressure gradient over the ocean will be seen, however, to be considerably steeper in the case of the China Seas than in that of the Indian Ocean. The China Sea gradient for January is very similar to the Indian Ocean gradient for July and hence the pressure maps give confirmation to the deduction made from the available observations in the second article of this series, that the N.E. China Seas Monsoon is of similar strength to the S.W. Indian Ocean Monsoon and vice versa.

On larger scale maps of pressure the 1009 mb. (29.8 in.) isobar is shown crossing the extreme east of the Mediterranean more directly from north to south than is indicated on Figure 1. This gives the northerly summer Monsoon experienced in that region. In winter the Asiatic high-pressure system does not reach the Mediterranean and there is no winter Monsoon.

The Circulation above the Monsoons.—In Figures 6 and 7 of the fourth article of the Trade Wind series, charts of isobars of the Northern Hemisphere were given for heights of 6,500 feet and 26,000 feet for the month of July. At the lower height the summer low-pressure area of the S.W. Monsoon is still in evidence, but at the greater height this has entirely disappeared, being replaced by an area of relatively high pressure. The charts constructed for intermediate heights, which have not been reproduced, show that at 13,000 feet the low-pressure area still exists in weakened form while at 19,500 feet the superimposed high-pressure area is just beginning to assert itself. We may therefore picture the monsoonal low-pressure areas as existing in gradually weakening intensity up to about 16,000 feet, above which the upper high-pressure area appears, gradually increasing in strength up to the height of the highest chart, 26,000 feet. It is therefore seen that the air current of the S.W. Monsoon extends much higher into the upper air than that of the Trade Winds, which while occasionally reaching a height of 12,000 feet or more, normally consists of a shallow layer not much exceeding 3,000 feet.

It is more difficult to construct the upper air pressure charts for a winter month such as January than for July, but it is probable even at the low height of 6,500 feet that the high pressure area of the N.E. Monsoon does not exist and that winds from some westerly direction blow over the whole of the Monsoon area. The N.E. Monsoon therefore occupies a shallow stratum, comparable to that of the Trade Winds.

These conclusions are in great measure confirmed by the actual observations of upper air winds and cloud motion made in India. These observations, commencing with those of Blanford and Eliot, have been investigated by Dr. Harwood and the following is a brief summary of his main conclusions. In the N.E. Monsoon period the upper wind blows from the west, strongly and steadily, over northern India while at the same season the upper wind over southern India is feeble and unsteady. This refers to the height of high cloud which may be taken as equivalent to the 26,000 feet of the highest pressure chart. At middle cloud height the west wind of northern India is strongly in evidence and there is a good deal of westerly wind even at low cloud level. In the S.W. Monsoon period the wind at high cloud level over Southern India is steady but not strong from the east, and at lower levels it is westerly. Over northern India the winds are westerly, fairly strong but unsteady.

We thus see that the upper westerly wind of northern India during the N.E. Monsoon season is fully in accordance with the pressure chart and probably represents a part of the circulation of a great low-pressure area centred at the North Pole and covering the greater part of the Northern Hemisphere. The feeble upper air winds of southern India during the season are mainly from some easterly direction and probably represent the outskirts of the general easterly upper air current of equatorial regions. The easterly upper air currents of southern India during the S.W. Monsoon season are in accordance with the upper air anticyclone of the pressure chart but the westerly winds of northern India are not, these representing the only real divergence between observations and theory. It is possible, however, that the anticyclonic circulation over the S.W. Monsoon is more fully established at a greater height than that to which the observations extend.

The Lesser Monsoons.

The S.W. African Monsoon.—The triangular region lying northward of a line drawn from Cape Palmas in latitude 4° N. to St. Paul de Loanda in latitude 10° S., which includes the Bights of Benin and Biafra, represents a region of south-westerly and southerly winds throughout the year. During the northern summer the area affected by these winds is more extensive. As the region of the N.E. Trade Wind of the North Atlantic Ocean moves northward the area of the S.W. Monsoon also moves northward and westward and in August the limiting line extends from a position in mid-Atlantic at latitude 10° N., longitude 35° W. to Cape Frio in latitude 18° S. From the mid-ocean position the line bends back sharply to the African coast in the vicinity of Cape Verde in latitude 15 °N. From February and August, therefore, the coast between Cape Verde and Cape Palmas experiences a S.W. wind, instead of the normal N.E. Trade Wind of the region. The same applies to the coast of Angola between Loanda and Cape Frio. This extension of the S.W. wind is progressive, so that while in Liberia the period of the Monsoon is about six months, it is shorter at Sierra Leone and further north at Dakar and Bathurst lasts only about a month. Similarly the S.E. Trade Wind becomes the S.W. Monsoon for six months at Loanda but in the Cape Frio region only for a few weeks.

This Monsoon is due to the difference of temperature between the continent of Africa and the ocean. In the northern summer nearly the whole of Africa north of the equator is covered by an extension of the Asiatic low-pressure system and the inflow of the S.W. Monsoon is produced by air drawn into this circulation from the anticyclone of the S.E. Trades of the Atlantic. During the southern summer the Bights occupy a position between this anticyclone and a centre of low pressure lying on the eastern side of Africa south of the equator and southerly or south-westerly winds blow over them in consequence.

The Australian Monsoon.—The N.W. Monsoon of the northern Australian waters and East Indies during the northern winter has already been referred to and it has also been shown that the N.W. Monsoon of the Indian Ocean has the same origin. At the opposite season, the southern winter, the high-pressure area covering Australia produces the S.E. wind of the East Indies and of the South Pacific Ocean as far as Longitude 160° W. This wind, so far as the East Indies are concerned, may be called either a Trade or a Monsoon. In the sense that the high-pressure area of Australia is merely an extension of the anticyclone of the South Indian Ocean it is a Trade. On the other hand the presence of the continent undoubtedly intensifies the pressure and extends the high-pressure area eastwards. The winds of southern Australian waters are influenced by the seasonal pressure changes, especially in the southern summer, but are not of sufficient regularity to be called Monsoons.

Fairly well-marked seasonal changes of prevailing wind are felt in the seas surrounding the south and west coast of Spain and around the south-eastern portion of the United States. These winds, though of a similar origin to the better developed Monsoons, are not usually termed Monsoons. Monsoonal effects are also felt on the coasts of Chili and elsewhere on the western side of South America.

SOUTHERN ICE REPORTS.

During the Years 1917 to 1928.

July.

Year.	Day.	Position of Ice.		Description.	Remarks.	Name of Ship reporting.
		Latitude.	Longitude.			
1917		No reports received.				
1924	19	55° 40′ S.	125° 55′ W.	Large berg	Height 235 feet, length 1,050 feet	S.S. *Port Victor*.
1926	23	54° 31′ S.	63° 11′ W.	Berg	About 80 feet high, 400 feet long	S.S. *Port Napier*.
1927	2	44° 05′ S.	54° 07′ E.	Large berg	Estimated length 800 feet, height 150 feet	S.S. *Mahana*.
	19	40° 18′ S.	73° 11′ E.	Berg	50 feet long (estimated) and just awash	S.S. *Balranald*.
	10	From 49° 25′ S. to 47° 50′ S.	52° 50′ W. 42° 50′ W.	Bergs of various sizes	There were numerous bergs in sight day and night at all times.	M.S. *Comliebank*.
	13	From 50° 23′ S. to 49° 23′ S.	52° 06′ W. 50° 51′ W.	4 large and 1 small bergs	Positions approximate. Most northerly berg was the largest, and was estimated to be about 800 feet high and 5,000 feet long with a flat top. The other 3 large bergs were about 300–400 feet high, and the small one about 100 feet.	S.S. *Tairoa*.
	13	46° 30′ S.	35° 05′ W.	5 bergs	..	M.S. *Comliebank*.
	14	46° 00′ S.	29° 55′ W.	Small berg	..	do.
		46° 00′ S	29° 40′ W.	2 large bergs	1 berg 240 feet high	do.
	15	44° 40′ S.	21° 40′ W.	Small berg	..	do.

Reports of ice previous to July, 1917, will be found on the back of the Monthly Meteorological Chart of the East Indian Seas, August 1917, No. 136.

WEATHER SIGNALS.

CHINA SEA.

II.—WIRELESS WEATHER SIGNALS.

WIRELESS WEATHER BULLETINS.

The Key and Decode Tables of the International Weather Telegraphy Code will be found on pages 21 to 25 of Volume VI No. 61. (The January, 1929, Number.)

The method of decoding station weather reports made in code was described in the British "Weather Shipping" Bulletin, on pages 45 to 47 of Volume VI No. 62. (The February, 1929, Number.)

FRENCH INDO-CHINA.

Mitho W/T Station, approximate Latitude 10° 21′ N., Longitude 106° 21′ E., call sign **FRM**, broadcasts weather bulletins at 0300 and 1330 G.M.T. on a wavelength of 600 metres, as follows:—

0300 G.M.T. Bulletin.

This bulletin commences with the words "Obs. 6 heures" and contains 2300 G.M.T. observations taken at the following stations:—

Fu Lien ...	Latitude	20° 49′ N.	Longitude	106° 47′ E. approx.)
Tourane ...	,,	16° 07′ N.	,,	108° 13′ E. ,,
Cape St. James	,,	10° 20′ N.	,,	107° 05′ E. ,,
Fort Bayard...	,,	21° 13′ N.	,,	114° 16′ E. ,,

Form of bulletin. One seven-figure group for each station is broadcast in the order given above. The group for Fort Bayard has six figures only.

Code used. The bulletins (with the exception of the seventh figure of each group) are broadcast in International Code, represented by "Key" letters as follows:—

BBBDDFS′

S′ = State of the sea. (Table XXXIII.)

The figure representing State of Sea is not broadcast for Fort Bayard.

Barometric readings are broadcast in mms. and tenths. *See* Table XXXIV to convert to mbs. and ins.

1330 G.M.T. Bulletin.

This bulletin is broadcast *en clair* and gives a summary of 0900 G.M.T. observations taken at Indo-China stations and 0600 G.M.T. weather conditions at Hong Kong. The observations of each station are broadcast in the following order:—

Barometric pressure, barometric tendency during the preceding 24 hours, wind direction and force (Beaufort), state of the sky, temperature and state of the sea.

The barometric tendency is given according to the following table:—

Barometer.		
mms.	ins.	
± 0 to 1	(·00–·04)=	Hausse (rise) or baisse (fall) Légère (slight).
± 1 to 2	(·04–·08)=	,, ,, ,, ,, Faible (small).
± 2 to 3	(·08–·12)=	,, ,, ,, ,, Moderée (moderate).
± 3 to 4	(·12–·16)=	,, ,, ,, ,, Assez forte (rather quickly).
± 4 to 6	(·16–·24)=	,, ,, ,, ,, Forte (quickly).
± 6 to 8	(·24–·31)=	,, ,, ,, ,, Très forte (very quickly).

Note.—It has been said that there is a "Zone of silence" along the Anam Coast, between Padaran and Varella Point which renders the reception of W/T signals from Mitho W/T Station difficult.

The same method of decoding weather reports applies in all cases where the International Code is used.

The letters given in the descriptions which follow give the key to the tables for decoding the figures.

Where *other* than International code tables are used they are published along with the signals described and an explanation is given.

HONG KONG.

Cape d'Aguilar W/T Station, Latitude 22° 13′ N., Longitude 114° 15′ E., call sign **VPS**, broadcasts weather bulletins in special code containing observations from various stations in the Far East at 0400, and 1200 G.M.T. on a wavelength of 600 metres, repeated at 0500 G.M.T. on 2800 m. I.C.W. and at 1300 G.M.T. on 2000 m. I.C.W., after Time Signal.

The observation stations included in these broadcasts, together with the hours at which the observations are taken are given in the lists below:—

As it has not been found possible to secure complete synchronisation, the barometer readings broadcast at 0400 G.M.T., will be reduced approximately to 2200 G.M.T. and those broadcast at 1200 G.M.T. to 0600 G.M.T.

0400 G.M.T. Bulletin.

Index Letters.	Station.	Position (approximate). Latitude.	Longitude.	Time of observation (G.M.T.).
NG	Nagasaki	32° 45′ N.	129° 53′ E.	2100
OS	Oshima	—	—	2100
NA	Naha	26° 13′ N.	127° 41′ E.	2100
IS	Ishigakijima ...	24° 20′ N.	124° 10′ E.	2100
IC	Ichang	30° 42′ N.	111° 16′ E.	2200
HW	Hankow	30° 35′ N.	114° 18′ E.	2200
KK	Kiu Kiang	29° 44′ N.	115° 59′ E.	2200
SH	Shanghai	31° 15′ N.	121° 30′ E.	2200
SP	Sharp Peak	25° 59′ N.	119° 27′ E.	2300
AM	Amoy	24° 27′ N.	118° 04′ E	2200
SW	Swatow	23° 23′ N.	116′ 42′ E.	2200
TK	Taihoku	25° 02′ N.	121° 31′ E.	2100
KH	Koshun	—	—	2100
PD	Pescadores	23° 30′ N.	119° 30′ E.	2100
HK	Hong Kong	22° 18′ N.	114° 10′ E.	2200
PR	Pratas Island ...	20° 42′ N.	116° 43′ E.	2200
PL	Phulien	20° 49′ N.	106° 47′ E.	2300
TR	Tourane	16° 07′ N.	108° 13′ E.	2300
CJ	Cape St. James ...	10° 20′ N.	107° 05′ E.	2300
BS	Basco	20° 26′ N.	121° 58′ E.	2200
AP	Aparri	18° 31′ N.	122° 07′ E.	2200
MN	Manila	14° 35′ N.	120° 59′ E.	2200
LG	Legaspi	13° 10′ N.	123° 45′ E.	2200
TC	Tacloban	11° 15′ N.	125° 00′ E.	2200
IL	Iloilo	10° 42′ N.	122° 34′ E.	2200
SU	Surigao	9° 48′ N.	125° 29′ E.	2200

Form of message. One group containing 12 figures is broadcast for each of the stations given in the list.

1st, 2nd, 3rd and 4th figures in each group give the corrected barometer reading.

5th and 6th figures in each group give the dry bulb temperature of the air in degrees F.

7th and 8th figures in each group give the wet bulb temperature.

9th and 10th figures in each group give the wind direction (00=N.; 04 = E.; 08 = S.; 12 = W., etc.).

11th figure in each group gives the wind force by Beaufort scale, forces of 9 and above being sent as 9.

12th figure in each group gives the weather according to the following table:—

0 = fine; blue sky or detached clouds.
1 = cloudy.
2 = overcast.
3 = fog or mist.
4 = thick fog.
5 = passing showers.
6 = rain or drizzle.
7 = snow or sleet.
8 = hail or rain and hail.
9 = thunderstorm.

A missing element is indicated by "Z," "ZZ" or "ZZZ."

A weather report and forecast follow the stations' reports.

1200 G.M.T. Bulletin.

Index Letters.	Station.	Position (approximate). Latitude.	Longitude.	Time of observation (G.M.T.).
SH	Shanghai	31° 15′ N.	121° 30′ E.	0600
SP	Sharp Peak	25° 59′ N.	119° 27′ E.	0600
AM	Amoy	24° 27′ N.	118° 04′ E.	0600
SW	Swatow	23° 23′ N.	116° 42′ E.	0600
TK	Taihoku	25° 02′ N.	121° 31′ E.	0300
KH	Koshun	—	—	0300
PD	Pescadores	23° 30′ N.	119° 30′ E.	0300
HK	Hong Kong	22° 13′ N.	114° 16′ E.	0600
PR	Pratas Island ...	20° 42′ N.	116° 43′ E.	0600
PL	Phulien	20° 49′ N.	106° 47′ E.	0700
TR	Tourane	16° 07′ N.	108° 13′ E.	0700
CJ	Cape St. James ...	10° 20′ N.	107° 05′ E.	0700
BS	Basco	20° 26′ N.	121° 58′ E.	0600
AP	Aparri	18° 31′ N.	122° 07′ E.	0600
MN	Manila	14° 35′ N.	120° 59′ E.	0600
LG	Legaspi	13° 10′ N.	123° 45′ E.	0600
TC	Tacloban	11° 15′ N.	125° 00′ E.	0600
IL	Iloilo	10° 42′ N.	122° 34′ E.	0600
SU	Surigao	9° 48′ N.	125° 29′ E.	0600

Form of message. Same form as 0400 G.M.T. Bulletin.

A weather report and forecast follow the stations' reports.

I.—Ship's Wireless Weather Signals.

"Selected Ships," *i.e.*, ships in the Fleet List with the letters ML or M appearing in the equipment column, when at sea in the China Sea, are invited to make their routine weather reports to "All Ships" as usual.

The times of Wireless Weather Telegraphy **observation** for all parts of the World are shown on the chart on p. 18 of the January, 1929, number.

When within range of **Cape d'Aguilar W/T Station** "Selected Ships" should address their reports to **VPS** as well as to **CQ**, making them on 2400 metres (C.W.) or 600 on Spk. Reply to messages on 2400 m will be made when necessary on 2800 m C.W.

Cape d'Aguilar W/T Station keeps continuous watch for ships' weather reports.

For particulars and sample of Ships' Wireless Weather reports *see* Chapter I of "Wireless and Weather an Aid to Navigation" and pages 17-19, Volume VI, No. 61 of this Journal.

Wireless Telephony, R/T Issues.

Victoria Peak W/T Station, approximate Latitude 22° 17′ N., Longitude 114° 09′ E., call sign **ZBW,** broadcasts by word of mouth weather reports and forecasts at 0548 and 1148 G.M.T. on 300 m (R.T.).

CHINA.

Pratas Island.

Spark and C.W. Issues.

Pratas Island W/T Station, approximate Latitude 20° 42′ N., Longitude 116° 43′ E., call sign **XPI,** broadcasts a daily weather report and forecasts based upon observations from about 90 stations in the Far East at:—

0600 G.M.T. (based upon 2200 G.M.T. observations) wavelength 600m. (spk.).

1100 G.M.T. (,, ,, 0600 ,, ,,) wavelength 600m. (spk.).

Repeated at 0610 and 1110 G.M.T. respectively, on a wavelength of 1450m. (C.W.).

The weather report and forecasts are broadcast *en clair* in English and are preceded by QST QST QST de XPI XPI XPI. The message is broadcast twice and contains the following information:—

Part I. Particulars regarding general atmospheric pressure distribution including the location of high and low pressure areas.

Part II. Location and expected direction of movement of depression, or typhoon, affecting the China Sea, Eastern Sea, Yellow Sea, Japan Sea (including the Pacific Ocean to the eastward) or S.E. of the Philippine Islands extending northward from Guam and adjacent islands to Northern Japan.

Part III. Wind and weather forecast for Formosa Channel, China Sea and neighbouring areas.

Part IV. Wind direction and force, and state of the weather at Pratas Island.

Weather reports are also transmitted on request free of charge.

SHANGHAI.

Spark Issues.

Shanghai W/T Station, approximate Latitude 31° 12′ N., Longitude 121° 26′ E., call sign **FFZ,** broadcasts weather bulletins *en clair*, in French and English, for China and the China Seas, on a wavelength of 750 metres (spark) at:—

0300 G.M.T., after Time Signal, containing observations made at 0100 G.M.T.

0900 G.M.T., after Time Signal, containing observations made at 0700 G.M.T.

1400 and 1800 G.M.T., containing observations made at 1200 G.M.T.

Note.—Owing to the alleged existence of "zones of silence" along the China Coast which apparently make reception of W/T messages difficult from Shanghai W/T station, weather bulletins and storm warnings will also be broadcast on a short wavelength of 34 metres at 1130 G.M.T. preceded by the general call and the call sign of **Shanghai W/T Station FFZ.**

These zones are said to be as follows:—

In the centre of Formosa Strait up to the Foochow Coast.
In the Gulf of Pechili behind Shantung Promontory, and
In the Yangtse-kiang river between Nanking and Chingkiang.

The range of the Shanghai W/T station short wave set has been ascertained to be approximately 2,000 miles.

JAPAN.

C.W. Issues.

The Central Meteorological Observatory, Tokyo, W/T Station, approximate Latitude 35° 39′ N., Longitude 139° 44′ E., call sign **JFRA**, broadcasts weather bulletins as follows:—

(1) **Synoptic data** messages giving a summary of the weather situation over Japan and the neighbouring seas by means of data, in special code (Japanese Meteorological) for twenty (or less) selected stations.

(2) **Storm warnings**, for particulars *see* p.   .

Synoptic data messages are broadcast as follows:—

At 0010 G.M.T. containing observations taken at 2100 G.M.T. (previous day).
„ 0600 G.M.T. „ „ „ 0300 „
„ 1110 „ „ „ „ 0900 „

Wavelengths at 0010 and 0600 G.M.T. 4,000 metres (C.W.) repeated on 600 metres (I.C.W.).
„ „ at 1110 G.M.T., 4,000 metres (C.W.) repeated on 750 metres (I.C.W.).

Method of transmission at all times is as follows:—

(1) Commencing signal: ▬ ▪ ▬ ▪ ▬ transmitted oncc.
(2) QST „ thrice.
(3) “de”: ▬ ▪ ▪ ▪ „ once.
(4) Call sign **JFRA** „ once.
(5) Message „ twice.
(6) End of message ▪ ▪ ▪ ▬ ▪ ▬ „ once.

List of Selected Meteorological Stations.

The synoptic data messages give the barometric reading, direction and force of the wind and the state of the weather, in code at a selection of the following twenty stations:—

Index Letter.	Name of Station.	Province.	Position (approx.).	
			Latitude.	Longitude.
A	Ishigakijima ...	Loochoo	24° 20′ N.	124° 10′ E.
B	Nafa	„	26° 13′ N.	127° 41′ E.
C	Nase	„	28° 23′ N.	129° 31′ E.
W	Kagoshima	Japan Proper	31° 34′ N.	130° 33′ E.
I	Murotozaki	„	33° 15′ N.	134° 11′ E.
F	Tomie	„	32° 37′ N.	128° 46′ E.
G	Sakai	„	35° 33′ N.	133° 04′ E.
V	Hamamatsu	„	34° 43′ N.	137° 43′ E.
H	Mera	„	34° 55′ N.	139° 50′ E.
J	Bonin Is.	„	27° 05′ N.	142° 11′ E.
K	Minatsuki	„	37° 22′ N.	136° 45′ E.
L	Ishinomaki	„	38° 26′ N.	141° 19′ E.
M	Hakodate	Hokkaido	41° 47′ N.	140° 43′ E.
N	Shana	„	45° 14′ N.	147° 53′ E.
O	Mokpo	Chosen (Korea)	34° 47′ N.	126° 20′ E.
S	Gensan (Wensan) ...	„	39° 11′ N.	127° 26′ E.
P	Yūki	„	42° 20′ N.	130° 24′ E.
Q	Dairen (Talien) ...	Manchuria	38° 54′ N.	121° 36′ E.
R	Changchun	„	43° 55′ N.	125° 18′ E.
T	Shanghai	China	31° 15′ N.	121° 30′ E.

When the information from one or more stations is lacking, data from the auxiliary stations in the following table will be broadcast in lieu.

List of Auxiliary Stations.

Index Letter.	Name of Station.	Province.	Position (approx.).	
			Latitude.	Longitude.
U	Taihoku	Formosa	25° 02′ N.	121° 31′ E.
D	Miyazaki	Kiushiu	31° 55′ N.	131° 26′ E.
Z	Nemuro	Hokkaido	43° 20′ N.	145° 35′ E.
X	Sonjin	N. Chosen	40° 30′ N.	129° 11′ E.
Y	Mukden	S. Manchuria	41° 48′ N.	123° 23′ E.

Form of Messages.

The synoptic data messages are broadcast in a collection of *letters* forming 20 groups (or less), each group consists of five letters.

1st letter in each group is the index letter of the observation station.

2nd and 3rd letters in each group give the corrected barometer reading in mm., Table XXXV (To convert to mbs. and ins. *see* Table XXXIV).

4th letter in each group gives the wind force by Beaufort Scale and the state of the weather, Table XXXVI.

5th and last letter in each group gives the wind direction, Table XXXVII.

SPECIAL WEATHER TELEGRAPHY TABLES, NOT NEW INTERNATIONAL CODE.

Table XXXIII.

State of the Sea—Mitho bulletin.

Code figure.		Code figure.	
0 =	Calm.	5 =	Rather rough.
1 =	Very smooth.	6 =	Rough.
2 =	Smooth.	7 =	High.
3 =	Slight.	8 =	Very high.
4 =	Moderate	9 =	Phenomenal.

Table XXXIV.

Conversion of Millimetres into Millibars and Inches.

Mm.	Mb.	In.	Mm.	Mb.	In.	Mm.	Mb.	In.
695	926·6	27·37	743	990·6	29·25	759	1011·9	29·88
700	933·2	27·56	744	991·9	29·29	760	1013·2	29·92
705	939·9	27·76	745	993·2	29·33	761	1014·6	29·96
710	946·6	27·95	746	994·6	29·37	762	1015·9	30·00
715	953·2	28·15	747	995·9	29·41	763	1017·2	30·04
720	959·9	28·35	748	997·2	29·45	764	1018·6	30·08
725	966·6	28·54	749	998·6	29·49	765	1019·9	30·12
730	973·2	28·74	750	999·9	29·53	766	1021·2	30·16
735	979·9	28·94	751	1001·2	29·57	767	1022·6	30·20
736	981·2	28·98	752	1002·6	29·61	768	1023·9	30·24
737	982·6	29·02	753	1003·9	29·65	769	1025·2	30·28
738	983·9	29·06	754	1005·2	29·69	770	1026·6	30·32
739	985·2	29·10	755	1006·6	29·73	775	1033·2	30·51
740	986·6	29·13	756	1007·9	29·76	780	1039·9	30·71
741	987·9	29·17	757	1009·2	29·80	785	1046·6	30·91
742	989·2	29·21	758	1010·6	29·84			

Japanese Meteorological Code.

Table XXXV—Barometric Pressure.

Tenths.	0	1	2	3	4	5	6	7	8	9
Millimetres.	Code Letters.									
less than 711	AA	—	—	—	—	—	—	—	—	—
711	AB	—	AC	—	AD	—	AE	—	AF	—
2	AG	—	AH	—	AI	—	AJ	—	AK	—
3	AL	—	AM	—	AN	—	AO	—	AP	—
4	AQ	—	AR	—	AS	—	AT	—	AU	—
5	AV	—	AW	—	AX	—	AY	—	AZ	—
6	BA	—	BB	—	BC	—	BD	—	BE	—
7	BF	—	BG	—	BH	—	BI	—	BJ	—
8	BK	—	BL	—	BM	—	BN	—	BO	—
9	BP	—	BQ	—	BR	—	BS	—	BT	—
720	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD
1	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN
2	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX
3	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH
4	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR
5	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB
6	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL
7	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV
8	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF
9	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP
730	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ
1	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ
2	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT
3	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD
4	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN
5	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX
6	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH
7	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR
8	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB
9	JC	JD	JE	JF	JG	JH	JI	JJ	JK	JL
740	JM	JN	JO	JP	JQ	JR	JS	JT	JU	JV
1	JW	JX	JY	JZ	KA	KB	KC	KD	KE	KF
2	KG	KH	KI	KJ	KK	KL	KM	KN	KO	KP
3	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ
4	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ
5	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT
6	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD
7	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN
8	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX
9	MY	MZ	OA	OB	OC	OD	OE	OF	OG	OH
750	OI	OJ	OK	OL	OM	ON	OP	OQ	OR	OS
1	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC
2	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM
3	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW
4	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG
5	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ
6	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA
7	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK
8	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU
9	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE
760	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO
1	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY
2	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI
3	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS
4	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC
5	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM
6	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW
7	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG
8	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ
9	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA
770	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK
1	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU
2	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE
3	XF	XG	XH	XI	XJ	XK	XL	XM	XN	XO
4	XP	XQ	XR	XS	XT	XU	XV	XW	XX	XY
5	XZ	YA	YB	YC	YD	YE	YF	YG	YH	YI
6	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS
7	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC
8	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM
9	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW
780	ZX	ZY	—	—	—	—	—	—	—	—
more than 780·1	ZZ	—	—	—	—	—	—	—	—	—

Table XXXVI.—Force of the Wind and State of the Weather.

Wind Force	0–1	2–3	4–6	6–7	8–9	10 and over.
Weather.	Code Letters.					
Fair	A	A	B	C	D	E
Cloudy	F	F	G	H	I	J
Rain	K	K	L	M	N	P
Snow	Q	Q	R	S	T	U
Fog	V	V	W	X	Y	Z

Note.—Although the same signs are given for "Calms" and "Light Winds," the former is always meant when the direction of the wind is omitted.

Table XXXVII.—Direction of the Wind.

Direction.	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calm.
Code Letter.	N	O	P	Q	E	F	G	H	S	T	U	V	W	X	Y	Z	C

WIRELESS STORM WARNINGS.

FRENCH INDO-CHINA.

Mitho W/T Station, call sign **FRM**, broadcasts typhoon or storm warnings in a special code, immediately after the weather bulletins at 0300 and 1330 G.M.T. and at other times, as necessary, on a wave-length of 600 metres.

Form of message:—

"Typhoon" $LLllD_1D_1K$ or "Coup de Vent" D_1D_1Q.

followed by a check figure equal to the sum of the figures of the preceding group.

Code:—

LL = Latitude (given in whole degrees) of the centre of the typhoon.

ll = Longitude ditto.

D_1D_1 = Forecast of the direction the typhoon (or storm) is likely to travel. The same as DD in the International Code with the following additions:—

51—In formation.
52—Two centres.
53—Direction unknown.
54—Stationary, or very slow.
56—Turning.
58—Filling up.

K = Radius and force.

1—± 120 miles; intensity unknown.
2—± 120 miles; intensity violent.
3—± 60 miles; intensity unknown.
4—± 60 miles; intensity violent.
5—Increasing.
6—± 30 miles; intensity unknown.
7—± 30 miles; intensity violent.
8—Exceptional velocity.
9—Continental depression.
0—Position unknown.

Q = Area threatened.
1—Coasts of Anam.
2—Gulf of Tongking and Swatow.
3—Formosa channel.
4—Formosa to Yangtse.
5—Yangtse to Shangtung.
6—Gulf of Pechili to Gulf of Yalu.
7—Sea of Japan.
8—North of Hokkaido.
9—East coast of Japan.
0—South of Kyushu.

These warnings are also broadcast by the following W/T stations in French Indo-China, in a similar manner to Mitho W/T.

W/T Station.	Position (approx.).		Call Sign.	Wavelength, Metres.
	Latitude.	Longitude.		
Cape Padaran ...	11° 22′ N.	109° 01′ E.	FRR	600
Tourane	16° 07′ N.	108° 13′ E.	FRI	600
Kien an	20° 48′ N.	106° 37′ E.	FRK	600 (spk)
Fort Bayard ...	21° 13′ N.	110° 23′ E.	FRF	600

HONG KONG.

Cape d'Aguilar W/T Station, call sign **VPS,** broadcasts typhoon warnings on 600 metres.

The warnings from Hong Kong observatory are broadcast on receipt and at 18 minutes past each hour until 1600 G.M.T. and the warnings from Shanghai and Manila are broadcast on receipt and repeated after an interval of 10 minutes.

Wireless Telephony R/T Issues.

Victoria Peak W/T Station, call sign **ZBW,** wave length 300 m. R/T, broadcasts by word of mouth typhoon warnings received from Hong Kong observatory immediately following the weather bulletins at 0548 and 1148 but when the Hong Kong local storm signals are displayed they will be broadcast on receipt and at 48 minutes past every hour until the signals are lowered. The warnings from Shanghai and Manila will be broadcast on receipt and repeated after an interval of 10 minutes, when the Hong Kong local storm signals are displayed.

CHINA.

Spark Issues.

Pratas Island W/T Station, call sign **XPI,** broadcasts typhoon warnings for the China Sea when necessary. The warnings are broadcast *en clair* in English and are preceded by the Danger Signal TTT (— — —). They are issued as frequently as changes are observed, or at such intervals as may be deemed most expedient. Wave length, 600 metres (spark).

Shanghai W/T Station, call sign **FFZ,** broadcasts typhoon and gale warnings, when necessary after the weather bulletins described on p. 158 at 0300 (after Time Signal), 0900 (after Time Signal), 1400 and 1800 G.M.T. The warnings are broadcast *en clair* and give information concerning the position of the centres of typhoons or continental depressions, for China and the China Seas.

Wavelength 750 metres (spark).

Typhoon Warnings Broadcast on Short Wavelength and also on request by Shanghai W/T. FFZ.

For the benefit of ships who experience difficulty in the reception of W/T messages from **Shanghai W/T Station, FFZ,** owing to the alleged existence of "Zones of silence" along certain portions of the China coast these warnings will, if necessary, be broadcast on a short wavelength of 34 metres at 1130 G.M.T.

Ships are invited in case of difficulty, to ask Shanghai W/T station, FFZ for **special typhoon warnings** which will be transmitted **free of charge.**

Particulars of these "zones" are given on p. 158.

JAPAN.

C.W. Issues.

The **Central Meteorological Observatory, Tokyo, W/T Station** call sign, **JFRA,** broadcasts storm warnings, when necessary, *en clair*, in English after the weather bulletins explained on p. 159. The warnings contain the following information:—approximate position of typhoon (or cyclone), the direction in which it is moving, or expected movement, or information concerning severe gales, or duration of monsoon, over Japan and the neighbouring seas.

Time 0010 G.M.T. } Wavelength 4,000 metres (C.W.) repeated on
,, 0600 G.M.T. } 600 metres (I.C.W.).
,, 1110 G.M.T. Wavelength 4,000 metres (C.W.) repeated on 750 metres (I.C.W.).

III.—WIRELESS TIME SIGNALS.

HONG KONG.

I.C.W. Issues.

Wireless time signals controlled by the Royal Observatory, Hong Kong are broadcast from **Cape d'Aguilar W/T Station,** Latitude 22° 12′ 39″ N., Longitude 114° 15′ 19″ E., call sign **VPS,** on a wavelength of 2,000 metres (I.C.W.) at the following times:—

G.M.T.

	h.	m.	s.		h.	m.	s.
	1	55	00	to	2	00	00
and from	12	55	00	to	13	00	00

The time signals consist of dots (- - - - - etc.) each of about 0.2 seconds duration, sent at every second, the 28th, 29th, 54th, 55th, 56th, 57th, 58th, and 59th seconds being omitted for the purpose of identifying the signals.

Preliminary warning signals are transmitted between 1h. 53m. 00s. and 1h. 55m. 00s., and between 12h. 53m. 00s. and 12h. 54m. 00s., G.M.T., as follows:—"CQ de VPSHK Time wait."

CHINA.

Wireless time signals controlled by Zikawei Observatory are broadcast by **Shanghai W/T Station,** Latitude 31° 13′ 16″ N., Longtitude 121° 27′ 47″ E., call sign **FFZ,** on a wavelength of 600 metres, after the general call (CQ de FFZ) in the following manner:—

G.M.T. h. m. s.		h. m. s.	
2 54 00 and 8 54 00	to	2 54 50 and 8 54 50	▬ ▬ ▪ ▬ ▬ ▪ ▬ ▬ ▪ etc.
2 55 00 and 8 55 00			▪ Time signal.
2 56 00 and 8 56 00	to	2 56 50 and 8 56 50	▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ etc.
2 57 00 and 8 57 00			▪ Time signal.
2 58 00 and 8 58 00	to	2 58 50 and 8 58 50	▬ ▪ ▪ ▬ ▬ ▪ ▪ ▬ ▬ ▪ ▪ ▬ etc.
2 59 00 and 8 59 00			▪ Time signal.

IV.—VISUAL STORM WARNINGS.

Hong Kong.

Local Storm Signals.

In addition to the China seas storm signals, symbols from which are displayed when necessary at Blackhead Hill, Kowloon, the following system of local storm signals is in force at Hong Kong.

Day Signals.

Signal.	Symbol.	Signification.
1	T	A typhoon exists which may possibly cause a gale at Hong Kong within 24 hours.
2	▲	Gale expected from the North (N.W. to N.E.).
3	▼	Gale expected from the South (S.E. to S.W.).
4	■	Gale expected from the East (N.E. to S.E.).
5	●	Gale expected from the West (N.W. to S.W.).
6	⧗	Gale expected to increase.
7	✚	Wind of typhoon force expected (any direction).

The symbol for Signal No. 1 is coloured *red*, the remaining symbols are *black*.

Signal No. 7 will be accompanied by three explosive bombs, fired at intervals of 10 seconds at the Water police station, and repeated at the Harbour Office.

The signals will be lowered when it is considered that all danger is over.

Day signals displayed at Harbour Office, H.M.S. *Tamar*, Gough Hill, W/T mast Royal Observatory, Green Island signal mast, a flagstaff on the premises of the Hong Kong and Kowloon Wharf and Godown Coy. at Kowloon, the Standard Oil Coy.'s flagstaff at Lai chi Kok, and a flagstaff near the field officers' quarters at Lye mun.

Night Signals (Lights).

Signal No. 1	2	3	4	5	6	7
WHITE	WHITE	GREEN	GREEN	WHITE	GREEN	RED
WHITE	GREEN	WHITE	GREEN	WHITE	GREEN	GREEN
WHITE	GREEN	WHITE	WHITE	GREEN	GREEN	RED

Night signals displayed, at sunset, on the tower of the railway station, W/T mast Royal Observatory, H.M.S. *Tamar*, Gough Hill, and on the Harbour Office flagstaff. **They have the same signification as the day signals.**

Signal No. 7 will be accompanied by explosive bombs, as above, in the event of the information conveyed by this signal being first published at night.

Supplementary Warnings.

When local signals are displayed in the harbour, signals will be displayed at the following stations:—

Aberdeen
Cheung chow
Gap rock
Ping shan
Stanley
Sau ki wan
Sai kung
Sha tau kok
Tai Po
Tsun wan
Tai O
Waglan

to notify the fact to native craft and passing ocean vessels.

The signals displayed are as follows:—

When No. 1 signal is displayed in the harbour:

Red **T** by day.
2 *red* lights vertically by night.

When Nos. 2 to 7 signals are displayed in the harbour:—

Black cone by day.
Two *green* lights vertically by night.

Further details can always be given to ocean vessels on demand, by signal from lighthouses.

The object of the system is to give at least 24 hours' warning of a gale (force 8 Beaufort scale) and also warnings of expected changes in the direction and force of the wind. Owing, however, to the uncertain movements of typhoons and to insufficient telegraphic observations it will occasionally happen that Signals 2 to 5 may be displayed without a gale occurring at Hong Kong, or even Gap rock, but the reverse is not likely to happen, except in the case of typhoons forming in the vicinity and travelling rapidly towards Hong Kong, or of a located typhoon increasing its rate of progression abnormally. Signal No. 1 is intended as a warning to "Stand by" and watch for the next signal.

NOTE.—The China seas storm signal system necessitates a masthead symbol which should not be mistaken for a black signal of the local system.

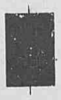
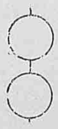
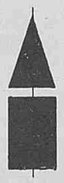
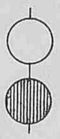
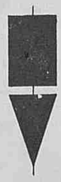
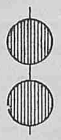
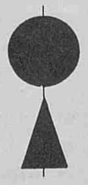
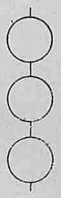
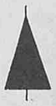
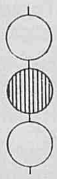
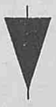
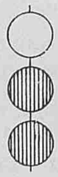
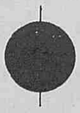
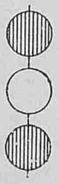
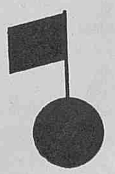
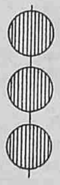
PHILIPPINE ISLANDS.

Typhoon Warning Signals.

TYPHOON warning signals are displayed upon receipt of information from the Weather Bureau at Manila, as follows:—

Day Signals.—Black cylinder, 1½ feet in diameter, 2 feet high. Black cone, base 1½ feet in diameter, 2 feet high. Black sphere, 2 feet in diameter. Flag, 3 or 4 feet square, of any convenient colour.

Night Signals.—*Red* and *White* lights shown vertically or horizontally.

Signal No.	By Day.	By Night.	Meaning.
1			**Indicates** (*a*) A distant typhoon the direction of whose movements is still unknown. The signal will be changed in case the typhoon approaches. (*b*) The direction of the distant typhoon is at present such that the storm may pass off without seriously affecting the archipelago. (*c*) A general warning, *viz.*, when the weather indications are dangerous but such as are not covered by any one of the other signals in use; for instance, when the typhoon recurves east of the archipelago. In such cases *see* the daily weather note posted at all the meteorological and telegraph stations and Custom houses. **Precautions.**—Vessels should prepare to strengthen their moorings and to get up steam. Small vessels, especially open launches, should not risk going far from port.
2			**Indicates** that the centre of the typhoon will pass (or is passing) to the northward at a considerable distance. Winds from west to south are to be expected, which may acquire considerable force and continue for several days. **Precautions.** — Vessels should strengthen their moorings. It is considered advisable that vessels should send down light yards and masts. Steam vessels should be ready to use their engines at short notice. Dangerous for small vessels to be in Manila bay.
3			**Indicates** that the centre of the typhoon will pass (or is passing) to the southward at a considerable distance. Winds from east to south are to be expected. These are generally less violent than those referred to in signal No. 2. **Precautions.**—As for signal No. 2.
4			**Indicates** that the location of the typhoon is dangerous for the place where the signal is hoisted, though the danger is not imminent. Look out for the next signal. **Precautions.** — Vessels should strengthen their moorings. Steam vessels must be ready to use their engines in case of sudden emergency. Small vessels must remain at their moorings.
5			**Indicates** that the centre of the typhoon will pass (or is passing) to the northward at a short distance. Strong winds from north, through west, to south are to be expected, which may become very violent. **Precautions.** — Vessels should strengthen their moorings as much as possible. Lower and secure all gear. Use steam to help anchors. Vessels outside Manila harbour may find it necessary to seek refuge in Kavite. No vessels should be under way while this signal is hoisted.
6			**Indicates** that the centre of the typhoon will pass (or is passing) to the southward at a short distance. Strong winds from north, through east, to south are to be expected, which may become very violent, though usually they are less severe than those referred to in signal No. 5. **Precautions.**—As for signal No. 5.
7			**Indicates** that the centre of the typhoon will pass over the place where the signal is hoisted. **Precautions.**—As for signal No. 5. It must be noted, however, that after the absolute or relative lull, due to the actual passing of the centre, the wind will suddenly change to a direction opposite to the one from which it came before the lull; also that it may often be more violent than before.
8			**Indicates** very high tides, and floods. **Precautions.**—Vessels of any description must not attempt to enter or leave a harbour or river, nor to move about inland waters while this signal is hoisted. The flag in this signal is of any convenient colour.

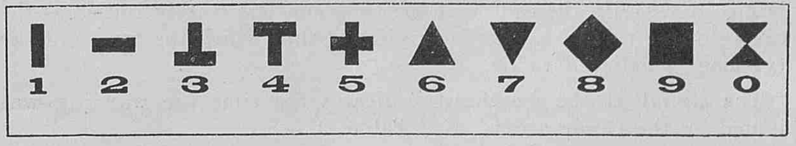
CHINA SEAS STORM SIGNAL SYSTEM.

Typhoon and Storm Signals.

The China seas storm signal system which has been drawn up by joint agreement between the observatories at Zi-ka-wei and Hanoi and the Chinese Maritime Customs, is now definitely adopted along the whole China coast, including Hong Kong and the Indo-China ports.

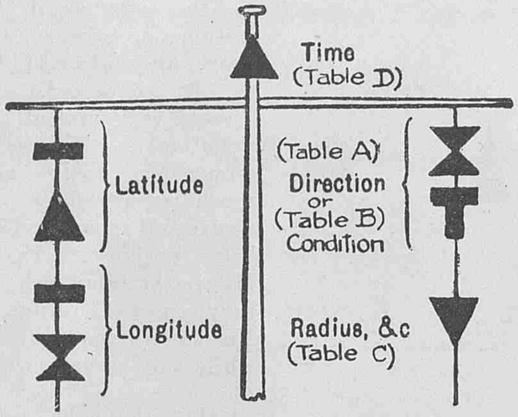
General Explanation.

The signals are made by means of certain symbols, each corresponding, for certain purposes, to a number:—



The symbols are hoisted at the yardarms and masthead of the storm-signal mast and have the general characteristics as shown below.

Typhoon Signal.



Meaning.—A severe typhoon within 30 miles of Lat. 26° N., Long. 120° E., travelling N.E. Warning issued this morning.

The two upper symbols, on one yardarm indicate latitude, 26°, the lower two figures longitude, the 100 being omitted, *i.e.*, 20 indicates longitude 120°.

The two upper symbols on the opposite yardarm indicate the direction in which a typhoon is travelling, *see* Table A.

TABLE A.

DIRECTION SIGNALS.

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
⊥ —	⧗ —	⧗ T	⧗ ▲	⧗ ◆	│ ⧗	│ —	│ T	│ ▲	│ ◆	— ⧗	— —	— T	— ▲	— ◆	⊥ ⧗

(*Note.*—The numbers corresponding to the symbols indicate the number of points from North or alternatively certain conditions of the typhoon, *see* Table B.)

TABLE B.

CONDITION SIGNALS.

Forming	*Two centres*	*Direction unknown.*	*Stationary or very slow.*	*Recurving.*	*Filling up.*
+ │	+ —	+ ⊥	+ T	+ ▲	+ ◆

The lower symbol on this side indicates the radius of the circle in miles whose centre is shown by the latitude and longitude. This symbol may also indicate degree of intensity. In the case of a continental depression it indicates that it is such, and the corresponding latitude and longitude is the centre of an indefinite area affected. *See* Table C.

TABLE C.

RADIUS AND INTENSITY SIGNALS.

	120'		60			30'				
Radius of position Circle.	│	—	⊥	T	+	▲	▼	◆	■	⧗
Intensity:	Unknown	Severe	Unknown	Severe	Deepening	Unknown	Severe	Excep. velocity	Contin. depres.	Position uncertain

Note.—It should be clearly understood that the position indicated is not necessarily the centre of the typhoon, but merely indicates the centre of a circle of a specified radius within which the centre of the typhoon is believed to lie.

The signal at the masthead indicates the time the warning was issued by the Observatory. *See* Table D.

TABLE D.

TIME SIGNALS.

Yesterday morning.	*Yesterday afternoon.*	*This morning.*	*This afternoon.*
■	◆	▲	▼

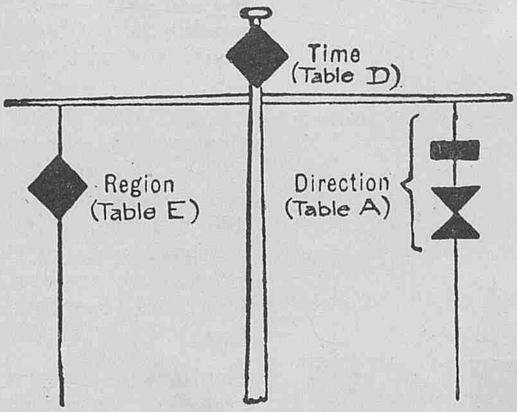
Note.—The position of the centre of the typhoon as signalled is the position according to the data possessed by the Observatory at the time of the issue of the warning; that data may be as much as 12 hours old. Thus, if the time signal indicates that the warning was issued "This morning," it may be that the position corresponds to data concerning yesterday afternoon.

If the signal "Deepening" is made, it indicates that there is reason to believe that the barometric gradient and, consequently, the intensity of the typhoon are increasing.

If the signal "Exceptional velocity" is made, it indicates that there is reason to believe that the rate of progression is 25 per cent. or more greater than the average rate.

If the signal "Position uncertain" is made, it indicates that the data possessed is unreliable and that the position signalled is a mere probability.

GALE SIGNALS.



Meaning.—The north coast of Hokkaido threatened by a gale from S.W. Warning issued yesterday afternoon.

The one symbol at one end of the yardarm shows the region threatened. *See* Table E.

TABLE E.

DISTRICT SIGNAL.

Coast of Annam.	G. of Tongking to Swatow	Formosa Strait.	Formosa to Yangtze.	Yangtze to Shantung.	G. of Yalu G. of Pechihli.	Sea of Japan.	North of Hokkaido.	East Coast of Japan.	South of Kiusiu.
│	—	⊥	T	+	▲	▼	◆	■	⧗

The two symbols at the other yardarm show the direction from which the gale is expected to blow. *See* Table A.

The symbol at the masthead shows the time the warning was issued by the Observatory. *See* Table D.

Note.—In addition to the above general signals, local storm signals are displayed at Hong Kong. *See* p. 162.

JAPAN.

Storm Signals.—The storm signals made at various places on the coasts of Japan consist of General storm signals and Local storm signals. The former, shown on special masts, give the time, the position, the direction, the rate of progressive movement and intensity of the storm, while the latter only furnish a general idea of the character of the storm expected.

General Storm Signals.

By day the signals are made from a mast with a yard by means of certain symbols; these symbols and their equivalent numbers are as follows:—

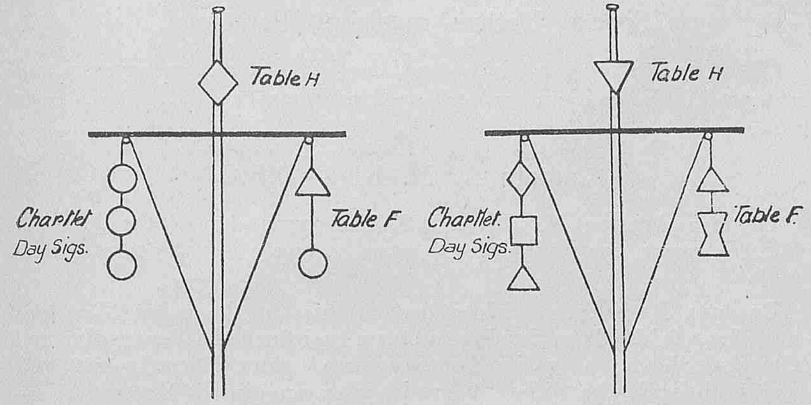
●	■	▲	▼	◆	⧗
1	2	3	4	5	6

The symbols are usually *red*, but in some places, to suit local conditions, they are *white*.

By night the signals are made by means of *red*, white, and *green* lights.

1. Day Signals.

Examples of Day Signals.



Meaning.

Last night, at 10 p.m. a typhoon or cyclone off the north-east coast of Japan moving towards north-east with a velocity of 10 to 20 miles per hour, the intensity not indicated.

Meaning.

This morning, at 6 a.m. a violent typhoon in northern Formosa moving towards the north-west, its velocity not indicated.

Three symbols, vertical, at one yardarm of the storm-signal mast, indicate the number of the district in which the centre of a typhoon or cyclone is situated. *See* Chartlet, Day Signals, p. 166.

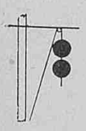
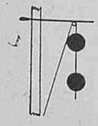
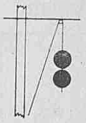
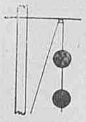
Two symbols at the other yardarm show the direction of the progressive motion. *See* Table F.

TABLE F.—Direction of Motion.

▲ ▲	▲ ◆	▲ ●	● ■	● ●	● ◆	▼ ●	▼ ■	▼ ▼	▼ ◆	▼ ⧗	⧗ ■	⧗ ⧗
N.	NNE.	NE.	ENE.	E	ESE.	SE.	SSE.	S	SSW.	SW.	WSW.	W.
⧗ ◆	▲ ⧗	▲ ■	◆ ■	■ ◆	⧗ ●	▼ ▲	▲ ▼					
WNW.	NW.	NNW.	Forming	Filling up	Unknown.	Recurving	Steady or Slow.					

The rate of progression is shown by changing the relative positions of the direction symbols to the yardarm. *See* Table G.

TABLE G.—Rate of Progression.

	Direction symbols separated by the normal distance.	Velocity not known.
	Direction symbols separated by twice normal distance.	10 to 20 miles per hour.
	Twice normal distance between yardarm and upper symbol.	20 to 30 miles per hour.
	Twice normal distance between yardarm and upper symbol. Also twice normal distance between the two symbols.	Above 30 miles per hour.

(In Table G the symbols represent an easterly movement of the typhoon.)

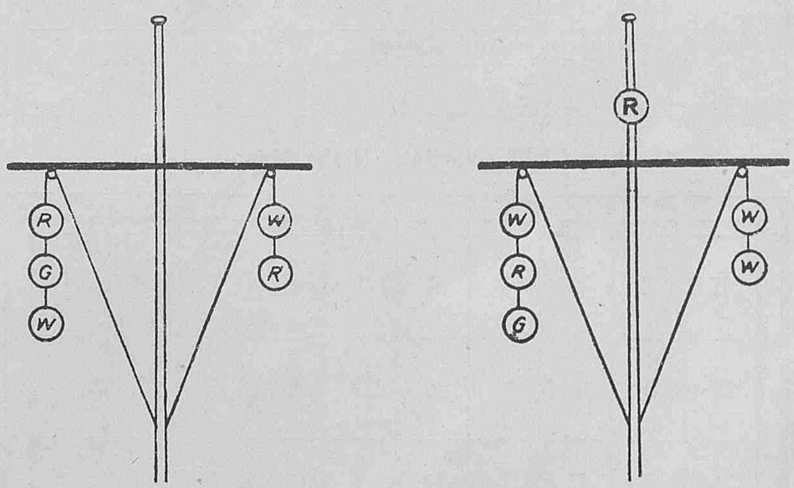
One symbol at the masthead shows the time at which the centre was located, and the intensity (force) of the typhoon. *See* Table H.

TABLE H.—Time and Force.

Time / Force.	This Morning 6 am.	This Afternoon 2 pm.	Last Night 10 pm.
Not indicated.	●	⧗	◆
Violent.	▼	▲	■

2. Night Signals.

Examples of Night Signals.



Meaning.

A cyclone or typhoon over Korea, moving towards the north-east.

Meaning.

A cyclone over Hokkaido, moving towards the east.

Three lights, *vertical*, at one yardarm indicate the district in which the typhoon or cyclone is situated. *See* Position Light Chartlet, p. 166.

One light at the masthead shows the subdivision of the district in which the centre is situated. *See* Table I. and Position Light Chartlet.

TABLE I.—Subdivision Light.

Ⓦ 1st Quadrant.	Ⓡ 2nd Quadrant.	Ⓖ 3rd Quadrant.	None 4th Quadrant.

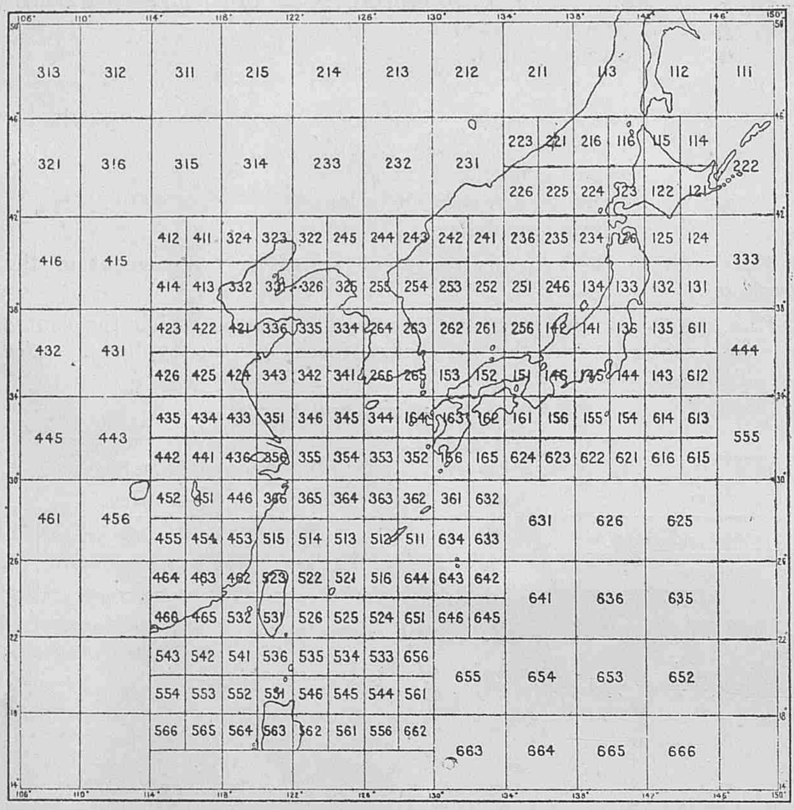
Two lights, vertical, at the other yardarm show the direction of the motion of the centre. *See* Table J.

TABLE J.—Direction of Motion Lights.

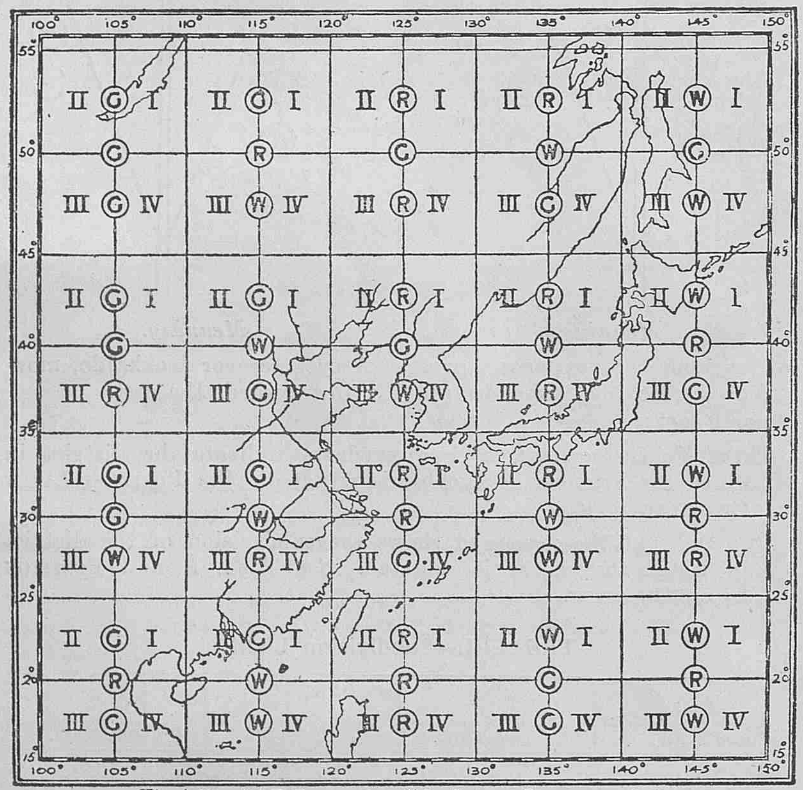
Ⓖ Ⓦ	Ⓦ Ⓡ	Ⓦ Ⓦ	Ⓡ Ⓡ	Ⓡ Ⓖ	Ⓡ Ⓦ	Ⓖ Ⓖ	Ⓦ Ⓖ
N.	NE.	E.	SE.	S.	SW.	W.	NW.

The letters W.R.G. in Tables I. and J. denote white, red, and green, respectively.

Chartlet indicating position of Storm Centre. Day Signals. Japan.


106° 110° 114° 118° 122° 126° 130° 134° 138° 142° 146° 150°
50° 46° 42° 38° 34° 30° 26° 22° 18° 14°
313 312 311 215 214 213 212 211 113 112 111
223 221 216 116 115 114
321 316 315 314 233 232 231 222
226 225 224 123 122 121
412 411 324 323 322 245 244 243 242 241 236 235 234 126 125 124
416 415 333
414 413 332 331 326 325 255 254 253 252 251 246 134 133 132 131
423 422 421 336 335 334 264 263 262 261 256 142 141 136 135 611
432 431 444
426 425 424 343 342 341 266 265 153 152 151 146 145 144 143 612
435 434 433 351 346 345 344 164 163 162 161 156 155 154 614 613
445 443 555
442 441 436 356 355 354 353 352 166 165 624 623 622 621 616 615
452 451 446 366 365 364 363 362 361 632
461 456 631 626 625
455 454 453 515 514 513 512 511 634 633
464 463 462 523 522 521 516 644 643 642
641 636 635
466 465 532 531 526 525 524 651 646 645
543 542 541 536 535 534 533 656
655 654 653 652
554 553 552 551 546 545 544 561
566 565 564 563 562 561 556 662
663 664 665 666

Position Light Chartlet. Night Signals, Japan.


100° 105° 110° 115° 120° 125° 130° 135° 140° 145° 150°
55 50 45 40 35 30 25 20 15
II G I II G I II R I II R I II W I
G R G W G
III G IV III W IV III R IV III G IV III W IV
II G I II G I II R I II R I II W I
G W G W R
III R IV III G IV III W IV III R IV III G IV
II G I II G I II R I II R I II W I
G W R W R
III W IV III R IV III G IV III W IV III R IV
II G I II G I II R I II W I II W I
R W R G R
III G IV III W IV III R IV III G IV III W IV

The letters W, R, G, denote White, Red, and Green, respectively.

Local Storm Signals.

These signals are made by day with either a *red* ball, a *red* cylinder, or a *red* cone; and by night by coloured lights, which have the following significance:—

Day Signals.	Night Signals.	Signification.
A *red* ball ...	A *red* light ...	Strong winds or gales expected.
A *red* cylinder	A *green* light...	Rain or snow storm.
A *red* cone ...	A *red* light over a *green* light.	Approach of a cyclonic storm of dangerous intensity.

Special Notices regarding Personnel.

The Marine Superintendent will be glad to receive information of special distinctions gained and retirements, &c., of Marine Observers.

Captain A. M. King, D.S.C.

Captain Arthur M. King, D.S.C., Commander of the P. & O. S.S. *Ranpura*, has retired from active service after 43 years' service afloat.

Captain King served his apprenticeship in the ships *Gladstone* and *Neotsfield*. Transferring to steam he joined the Peninsular and Oriental Steam Navigation Company as a Junior Officer in 1892, and rising through the different grades was appointed Master of the *Banca* in 1914. Since then he has commanded several of the Company's Mail Steamers, his last vessel being the *Ranpura*.

The Voluntary Corps of Marine Observers of which Captain King has been a member since 1921 will join with the Marine Division in wishing him long life and happiness in his retirement.

Obituary.

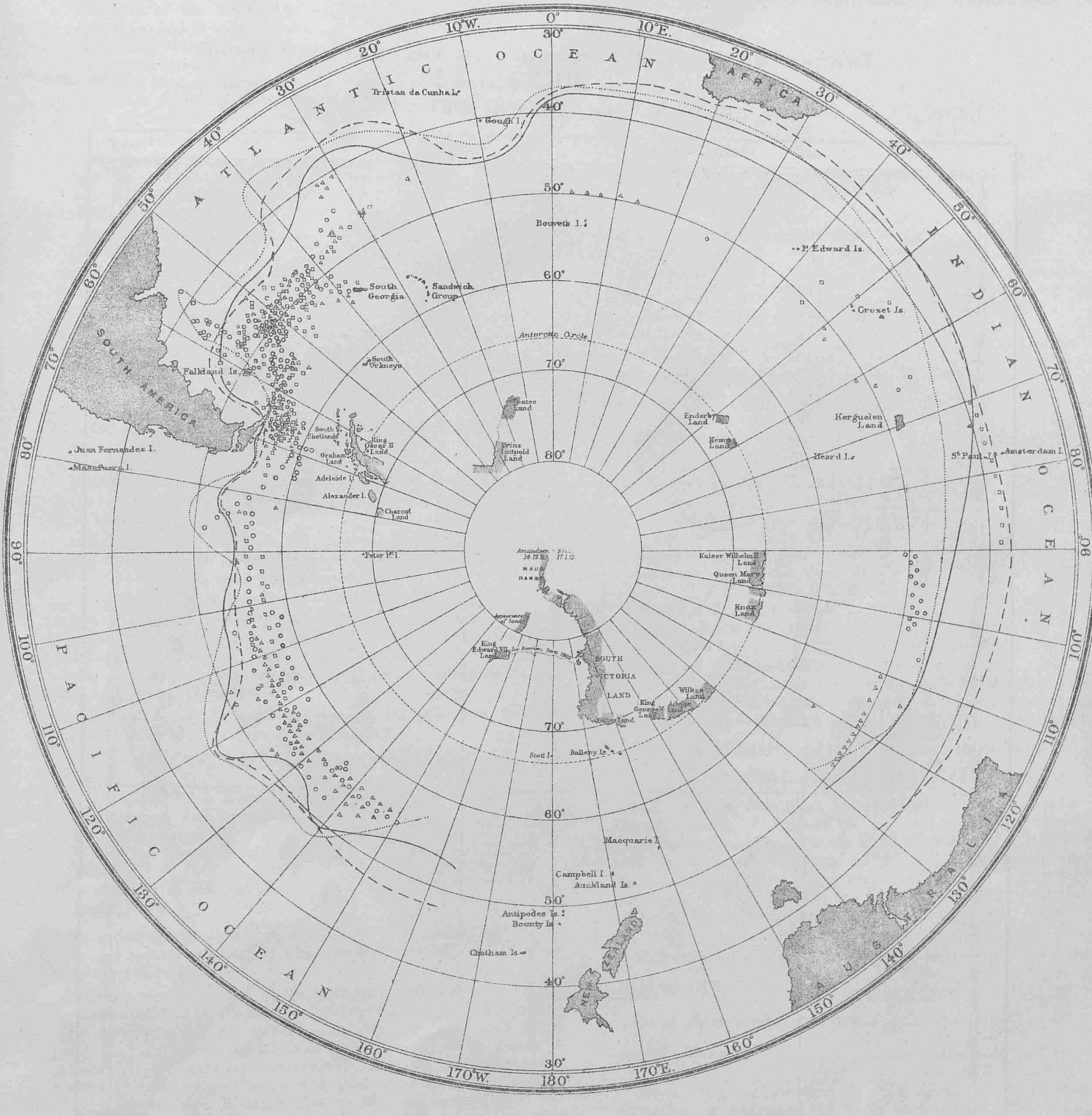
The death of Captain A. E. S. Hambelton, C.B.E., formerly Commander of the White Star Liner *Olympic*, which occurred at a Nursing Home at Golders Green on April 27th, is noted with regret.

Captain Hambelton was born in 1862 and at the age of 14 was apprenticed to Messrs. Gosman & Smith, serving his time in the ship *Deerhound*. On completing his time he served in the same ship as 3rd mate and then did a voyage in steam, but returned to sail, making voyages in several ships before he joined the Pacific Steam Navigation Company on the West Coast of South America service in 1886.

In 1892 he transferred to the White Star Line as fourth officer and rising through the several grades obtained his first command in 1901 when he was appointed Master of the *Gaelic*. From then on he commanded several of the finest ships of the White Star Fleet, his last ship being the *Olympic*, the command of which he relinquished in 1923, when he retired from Active Service afloat owing to ill-health.

Captain Hambelton was a member of the Corps of Voluntary Marine Observers from 1920 to the time of his retirement.

Vol. VI. No. 67.


ATLANTIC OCEAN
INDIAN OCEAN
PACIFIC OCEAN
AFRICA
SOUTH AMERICA
AUSTRALIA
NEW ZEALAND
Tristan da Cunha I.
Gough I.
Bouvets I.
South Georgia
Sandwich Group
South Orkneys
Falkland Is.
South Shetlands
King Oscar II Land
Graham Land
Adelaide I.
Alexander I.
Charcot Land
Peter Ist I.
Coats Land
Prinz Luitpold Land
Antarctic Circle
Enderby Land
Kemp Land
Kerguelen Land
Heard I.
Crozet Is.
P. Edward Is.
St Paul I.
Amsterdam I.
Kaiser Wilhelm II Land
Queen Mary Land
Knox Land
Wilkes Land
Adelie Land
King George V Land
Oates Land
SOUTH VICTORIA LAND
King Edward VII Land
Appearance of land
Ice Barrier
Amundsen 14.12.11
Scott 17.1.12
MAUD RANGE
Scott I.
Balleny Is.
Macquarie I.
Campbell I.
Auckland Is.
Antipodes Is.
Bounty Is.
Chatham Is.
Juan Fernandez I.
Masafuera I.
0°
10°E.
10°W.
20°
30°
40°
50°
60°
70°
80°
90°
100°
110°
120°
130°
140°
150°
160°
170°W.
170°E.
180°

ICE CHART OF THE SOUTHERN HEMISPHERE, 1902—1928.

JULY AUGUST, AND SEPTEMBER

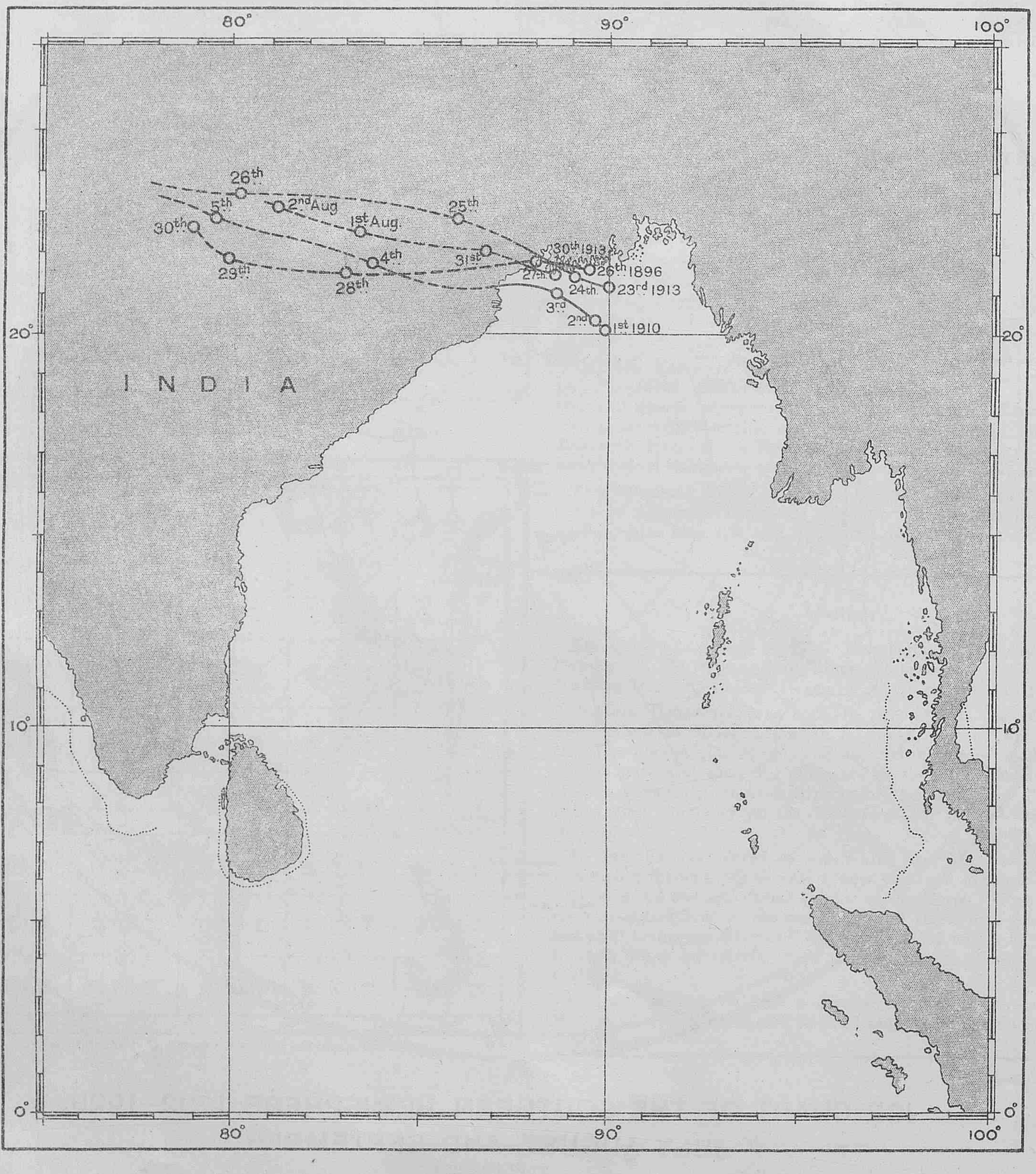
EXPLANATION.

The symbols used to distinguish the records of each of the three months represented during the period 1902—1928, are as follows :— July bergs △ , pack ice, ∿∿∿∿∿ August bergs □ , pack ice, ⊔⊓⊔⊓⊔⊓ September bergs ○ ; pack ice o-o-o-o-o . Extreme limits are given thus :– July ———— ; August — — — September .... ; these include ice reported since 1772.

A list of Southern Ice Reports during the years 1917-1928 for the month of July will be found on p. 156 of this Number.

Similar lists for the months of August and September will be published in the appropriate issues. Numbers 68 and 69 of this Volume.

TRACKS OF SEVERE CYCLONES IN THE BAY OF BENGAL
JULY,
DURING THE YEARS 1891 – 1923.


80°
90°
100°
26th
2nd Aug
25th
5th
1st Aug.
30th
31st
30th 1913
4th
26th 1896
27th
29th
28th
24th.
23rd 1913
3rd
2nd
1st 1910
20°
INDIA
10°
0°

The above are tracks of severe storms taken from "Storm Tracks in the Bay of Bengal" compiled by Dr. C.W.B. Normand and published by the India Meteorological Department.

H. M. Stationery Office Press, Kingsway W.C. 2.

1562/1593. Wt. 88 A. D.13. 1250. 5/29.

VERY IMPORTANT. NOTICES.

SELECTED SHIPS.

Routine Wireless Weather Reports.

In All Oceans.

The attention of the Masters of all ships fitted with Wireless Telegraphy is invited to these reports, particulars of which are given in Wireless and Weather an Aid to Navigation, Chapter I and Appendix I, and guidance for their use is given in the remaining chapters of this book. "Selected Ships" are requested to take the greatest care in drafting these reports, always preserving the sequence of particulars and elements when possible.

The set and drift of current, with positions *from* and *to*, should be included in these reports when this can be found with reliance. The importance of including recent informaton of ice sighted or received, with its position, cannot be too strongly advocated, particularly on the trade routes of the Southern Ocean.

Any ship at any time observing the formation of a Tropical Revolving Storm should make an urgent report to all ships and the nearest appropriate station in the form suggested in Wireless and Weather an Aid to Navigation.

A Tropical Revolving Storm having been reported, "Selected Ships" should make their routine reports as usual, and where there are not sufficient "Selected Ships" in the vicinity of a Tropical Revolving Storm other ships should assist in carrying out this service, being careful to use the same procedure and not to jamb each other.

The Commanders of "Selected Ships" are asked to have great care taken that the position of the ship given in these reports is the most accurate possible, for not only are they used in conjunction with Meteorological work, but they may give useful information to all ships in the vicinity in hazy weather, particularly if course and speed is indicated.

Remarks upon any use made of these reports for navigational purposes, in addition to meteorology and navigation, particularly if the Direction Finder is used, will be welcomed.

The function of "Selected Ships" in this Voluntary system is to provide and communicate to *all ships* useful Marine Meteorological information for safe navigation, at the same time communicating to Meteorological Centres as required useful information for their purposes, and on each occasion as far as possible doing so by one message and one transmission.

The particulars at the commencement of the standard form of message are those most generally essential, viz. :—

The address: i.e., CQ and specified station call sign when required.
The distinguishing Word: i.e., Weather.
The Latitude and Longitude,
Barometer corrected,
Wind True Direction and Force,
Weather,
G.M. Time of observation.
Date.

The remaining particulars should be given with careful regard to locality and requirements, preserving the sequence but not including unnecessary information.

The change or tendency of the barometer with course and speed is most useful when the ship is actually in or near a depression. The set and drift of current with position *from* and *to* is valuable information to all ships but especially so in localities where currents are strong or variable, and this information has increased value if considered with past experience and the conditions shown by a Weather Chart. Air and sea temperatures are more important in localities where fog may be met than for example in the Tropics.

Swell and its direction may be of special significance in the regions of Tropical Revolving Storms or other intense depressions.

The value of information of Past Weather is greatest after a decided change. Information of Ice derelicts, etc., is so important that this should be obvious.

The name of the ship should be always given at the end of the message as the Master's authority and as a means of identification.

PARTICULARS FOR APPLICATION BY INTENDING MARINE OBSERVERS.

Commanders and Officers who wish to have their names placed on the list of regular observing ships, or Commanders on transfer who wish to continue will greatly assist by furnishing the following particulars to the Agents at the ports, or at ports where Agencies do not exist, to the Marine Superintendent, Meteorological Office, London.

Name of Ship
Port of Registry
Steam, Motor or Sail, with Rig
Gross Tonnage
Name of Captain
Owners
Address
Trade in which usually employed, naming route and principal ports.
The name and rank of the Officer whom it is intended shall act as principal observer.
If Captain and principal observing officer are old marine observers, state name of last ship from which returns were made.
Description of Barometer carried, stating whether Mercurial or Aneroid, height above water line, and, if possible, giving three recent readings taken in port at 0100 G.M.T., 0700 G.M.T., 1300 G.M.T., and 1800 G.M.T.; giving dates and times, for comparison.
Nature of W/T installation.

When a Commander on transfer wishes to take the place of his ship in the fleet list to his new Command, in sending notification it should be made clear whether his relief wishes to carry on or not.

For list of Agents and their addresses, see overleaf.

POSTAL ARRANGEMENTS.

The Marine Observer is published, when circumstances permit, on the first Wednesday of the month previous to that to which the number refers.

If captains of observing ships will forward to the Meteorological Office the particulars required hereunder, endeavour will be made as far as mails permit to post the latest number for use on their homeward passage.

S.S............................. *Captain*..............................

Port of Call...

Date of Homeward Departure...

Postal Address...

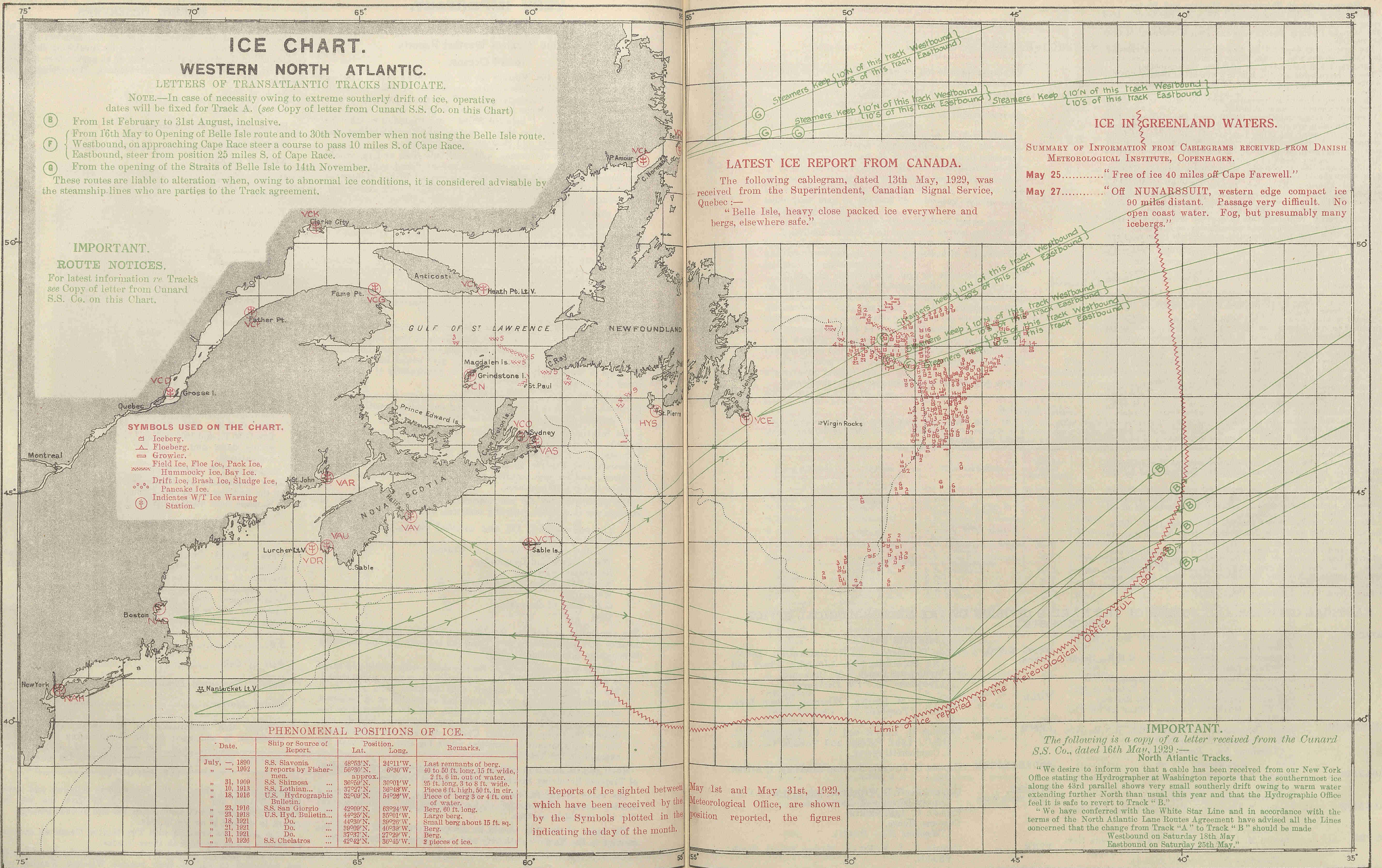
When this information is not given The Marine Observer is addressed to the Commanding Officer, s.s. ...., c/o the owners, and captains are requested to make their own arrangements for forwarding.

ICE REPORTS.

Commanders of ships in the Trans-North Atlantic and Southern Ocean Trades are earnestly requested to have the Ice Report Form 912 completed and returned at the end of each passage. A nil return is desired if no ice is seen.

These forms are supplied with The Marine Observer each month to regular observing ships in these Trades.

"Selected Ships" on the Trade Routes of the Southern Ocean are requested to add to their routine Wireless Weather reports information of floating ice seen or reported within the last 24 hours so that this information may be disseminated to the utmost advantage of all concerned.


Clarke City
VCK
Anticosti
Heath Pt. Lt.V.
VCH
Fame Pt.
VCG
Father Pt.
VCF
VCD
Grosse I.
Quebec
Montreal
GULF OF ST LAWRENCE
NEWFOUNDLAND
P. Amour
VCA
C. Norman
Belle Is.
VCM
Magdalen Is.
Grindstone I.
VCN
St. Paul
C. Ray
St. Pierre
HYS
St. Johns
VCE
Virgin Rocks
Prince Edward Is.
Cape Breton Is.
Sydney
VCO
VAS
St. John
VAR
NOVA SCOTIA
Halifax
VAV
VAU
Lurcher Lt.V.
VDR
C. Sable
Sable Is.
VCT
Boston
NAQ
New York
NAH
Nantucket Lt.V.
Steamers Keep { 10'N of this track Westbound / 10'S of this track Eastbound }
Limit of Ice reported to the Meteorological Office JULY 1901-1928
75° 70° 65° 60° 55° 50° 45° 40° 35°
50° 45° 40°

ICE CHART.

WESTERN NORTH ATLANTIC.

LETTERS OF TRANSATLANTIC TRACKS INDICATE.

NOTE.—In case of necessity owing to extreme southerly drift of ice, operative dates will be fixed for Track A. (*see* Copy of letter from Cunard S.S. Co. on this Chart)

Ⓑ From 1st February to 31st August, inclusive.

Ⓕ From 16th May to Opening of Belle Isle route and to 30th November when not using the Belle Isle route. Westbound, on approaching Cape Race steer a course to pass 10 miles S. of Cape Race. Eastbound, steer from position 25 miles S. of Cape Race.

Ⓖ From the opening of the Straits of Belle Isle to 14th November.

These routes are liable to alteration when, owing to abnormal ice conditions, it is considered advisable by the steamship lines who are parties to the Track agreement.

IMPORTANT. ROUTE NOTICES.

For latest information *re* Tracks *see* Copy of letter from Cunard S.S. Co. on this Chart.

SYMBOLS USED ON THE CHART.

- ⛫ Iceberg.
- △ Floeberg.
- ▭ Growler.
- 〰 Field Ice, Floe Ice, Pack Ice, Hummocky Ice, Bay Ice.
- °°° Drift Ice, Brash Ice, Sludge Ice, Pancake Ice.
- ⊕ Indicates W/T Ice Warning Station.

PHENOMENAL POSITIONS OF ICE.

Date.	Ship or Source of Report.	Position. Lat.	Long.	Remarks.
July, —, 1890	S.S. Slavonia ...	48°53′N.	24°11′W.	Last remnants of berg.
" —, 1902	2 reports by Fishermen.	56°30′N. approx.	6°30′W.	40 to 50 ft. long, 15 ft. wide, 2 ft. 6 in. out of water.
" 31, 1909	S.S. Shimosa ...	36°59′N.	30°01′W.	25 ft. long, 3 to 8 ft. wide.
" 10, 1913	S.S. Lothian... ...	37°27′N.	36°48′W.	Piece 6 ft. high, 50 ft. in cir.
" 18, 1916	U.S. Hydrographic Bulletin.	32°09′N.	54°26′W.	Piece of berg 3 or 4 ft. out of water.
" 23, 1916	S.S. San Giorgio ...	42°09′N.	63°24′W.	Berg, 60 ft. long.
" 23, 1918	U.S. Hyd. Bulletin...	44°25′N.	35°01′W.	Large berg.
" 18, 1921	Do. ...	44°30′N.	39°26′W.	Small berg about 15 ft. sq.
" 21, 1921	Do. ...	39°09′N.	40°39′W.	Berg.
" 31, 1921	Do. ...	37°37′N.	27°29′W.	Berg.
" 10, 1926	S.S. Chelatros ...	42°42′N.	36°45′W.	2 pieces of ice.

Reports of Ice sighted between May 1st and May 31st, 1929, which have been received by the Meteorological Office, are shown by the Symbols plotted in the position reported, the figures indicating the day of the month.

LATEST ICE REPORT FROM CANADA.

The following cablegram, dated 13th May, 1929, was received from the Superintendent, Canadian Signal Service, Quebec :—

"Belle Isle, heavy close packed ice everywhere and bergs, elsewhere safe."

ICE IN GREENLAND WATERS.

SUMMARY OF INFORMATION FROM CABLEGRAMS RECEIVED FROM DANISH METEOROLOGICAL INSTITUTE, COPENHAGEN.

May 25............"Free of ice 40 miles off Cape Farewell."

May 27............"Off NUNARSSUIT, western edge compact ice 90 miles distant. Passage very difficult. No open coast water. Fog, but presumably many icebergs."

IMPORTANT.

The following is a copy of a letter received from the Cunard S.S. Co., dated 16th May, 1929 :—

North Atlantic Tracks.

"We desire to inform you that a cable has been received from our New York Office stating the Hydrographer at Washington reports that the southernmost ice along the 43rd parallel shows very small southerly drift owing to warm water extending further North than usual this year and that the Hydrographic Office feel it is safe to revert to Track "B."

"We have conferred with the White Star Line and in accordance with the terms of the North Atlantic Lane Routes Agreement have advised all the Lines concerned that the change from Track "A" to Track "B" should be made

Westbound on Saturday 18th May
Eastbound on Saturday 25th May."

1562/1895. Wt. 88A. D.13. 1050. 5/29.

H.M.S.O. Press, Kingsway, W.C.2.

NOTICES.

MARINE METEOROLOGY.

Co-operation of Shipowners, Masters and Mates.

The Director of the Meteorological Office is authorised to lend tested Instruments to Captains of British-owned ships who undertake to make 4 hourly observations and keep Meteorological Logs for the Office.

The instruments supplied for this purpose are one barometer, four thermometers with screen, two hydrometers and in some cases a Barograph and rain gauge is added to the equipment.

Tested instruments are also lent to a number of British Atlantic Liners which make special coded W/T weather reports to the Office.

The number of ships co-operating with the M.O. using official tested instruments on loan is limited.

Vessels observing regularly for the Meteorological Office to which office instruments are not lent, keep Form 911, Ship's Meteorological Report, using the ship's instruments, the barometer being compared with Standards. The number of ships regularly contributing approved forms of all descriptions to the Marine Division is limited to 500.

Captains and Officers who wish to co-operate with the Meteorological Office should apply *by letter to* The Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2; or *in person* between the hours of 10 a.m. and 4 p.m., to the Marine Superintendent at the same address or to any of the gentlemen whose names and addresses are given below acting as agents at the respective ports. A waiting list is kept of the names of ships whose commanders have offered to regularly co-operate.

Marine Observers (*i.e.*, Captains and Officers who regularly observe for the Meteorological Office) will greatly assist if they will send in Meteorological Logs immediately on completion through the Port Meteorological Officer or Agent, at the same time notifying him of any possible instrumental defects.

Defective instruments will then be replaced and new Log Books, etc., provided.

In London and at base ports where there is not an Agency, notification of defects should be sent to headquarters on arrival, with the Meteorological Log.

Vessels making voyages of less than two months' duration are requested to retain their logs until nearly filled up, but the log should be returned in all cases at least twice yearly.

W/T Registers and Forms 911 should in all cases be sent directly to the Meteorological Office, London. The Port Meteorological Officer at Liverpool and the Visiting Officer in London board vessels co-operating with the Meteorological Office, and the agents visit ships at their ports when circumstances permit.

Postage abroad incurred on behalf of the Meteorological Office in returning logs will be refunded. Postage from British Empire ports need not be prepaid, if the envelope is marked O.H.M.S., and addressed to the Director, Meteorological Office, London.

Captains and Officers whether they observe regularly for the Meteorological Office or not are urged to report exceptional phenomena in air or sea. Reports of weather experienced in or near Tropical Cyclones or hurricanes, also abnormal currents are specially desired.

Ships on the List of Voluntary Observers to the Meteorological Office which have a mercurial barometer are indicated by the letters M.L., W.T. and M.

These are selected ships for reporting weather observations made at specified times by W/T to "All Ships," and they are *invited* to perform this service, which is for the benefit of all shipping fitted for W/T reception.

For sample weather report message see Chapter I. of "Wireless and Weather an Aid to Navigation," page 6, and page 19 of Vol. VI., No. 61.

THE MARINE OBSERVER is sent monthly to all ships regularly contributing Logs, Forms and W/T Registers to the Meteorological Office. It is hoped that each ship will preserve *all* her copies. Personal copies of Numbers are sent to those whose special contributions are published in them. A suitable cover may be obtained from H.M. Stationery Office, price 2*s*.

LATE PRESS.

DERELICTS AND FLOATING WRECKAGE.

Date.	Position.		Description.
	Latitude.	Longitude.	
	BALTIC.		
17.5.29	55°—′N.	14°—′E.	Quantity of wreckage, among which was bridge house, drifting Southward.
18.5.29	55°19′N.	11°02′E.	Submerged obstruction.
22.5.29	15 miles from Kappelludden S.E. by S.		Big log, dangerous to navigation.
	NORTH SEA.		
16.5.29	54°40′N.	1°20E.	Floating wreckage, painted white, probably Danish fishing vessel.
	ENGLISH CHANNEL.		
8.5.29	49°13′N.	3°38′W.	Drifting waterlogged boat.
18.5.29	49°38′N.	2°50′W.	Buoy marked Telegraph *No. 4* painted red and white with red and black vertical flag on top.
	NORTH ATLANTIC.		
1.5.29	35°03′N.	75°10′W.	Heavy spar, covered with barnacles, apparently attached to submerged wreckage.
1.5.29	49°42′N.	6°43′W.	Wreckage with red flag attached.
2 5.29	41°48′N.	61°16′W.	Large whistle buoy, painted red.
2.5.29	49°03′N.	17°47′W.	Red nun buoy.
2.5.29	45°41′N.	50°21′W.	Spar showing 6 feet out of water.
3.5.29	23°45′N.	18°28′W.	Submerged vessel, masts standing, bearing tattered flags: signals unreadable.
4.5.29	41°27′N.	54°48′W.	Red buoy marked *2AG* showing 6 feet out of water.
4.5.29	40°29′N.	42°49′W.	Mast projecting vertically about 8 feet out of water, apparently attached to submerged wreckage: mast was about 2 feet in diameter.
4.5.29	41°27′N.	54°48′W.	Red conical buoy marked *2A* over *FP*.
4.5.29	36°35′N.	52°14′W.	Small spar buoy showing about 5 feet out of water with barnacles.
5.5.29	39°19′N.	55°49′W.	Black can buoy marked *39*.
7.5.29	40°31′N.	44°55′W.	Red iron cylinder about 40 feet long and 6 feet in diameter.
8.5.29	40°38′N.	42°36′W.	Spar floating upright projecting about 5 feet out of water, apparently attached to submerged wreckage.
8.5.29	40°38′N.	42°34′W.	Log about 15 feet long.
8.5.29	39°12′N.	73°52′W.	Black can buoy.
9.5.29	21°42′N.	17°32′W.	Mast bearing 3 rectangular flags and a black buoy drifting South.
11.5.29	42°03′N.	45°16′W.	Spar projecting about 3 feet out of water, apparently attached to submerged wreckage.
11.5.29	26°44′N.	74°02′W.	Partly submerged wreckage about 150 feet long.
12.5.29	36°57′N.	74°25′W.	Submerged wreckage with spar projecting about 10 feet out of water.
13.5.29	32°57′N.	47°15′W.	Schooner *Quaco Queen* sighted with bowsprit and 40 feet of mizzenmast standing.
15.5.29	47°12′N.	13°09′W.	Conical buoy encrusted with marine growth.
19.5.29	48°15′N.	5°28′W.	Heavy spar 60 feet long, sailing vessel's lower mast, white cleats visible. Considered dangerous to navigation.
	GULF OF MEXICO.		
1.5.29	29°19′N.	92°45′W.	Can buoy.
4.5.29	28°48′N.	86°16′W.	Rusty can buoy covered with marine growth.
4.5.29	29°13′N.	92°31′W.	Black can buoy.
7.5.29	28°33′N.	90°57′W.	Tree trunk about 30 feet long and 3 feet in diameter.
7.5.29	28°29′N.	92°43′W.	Tree trunk about 2 feet in diameter projecting vertically about 8 feet out of water.
8.5.29	29°17′N.	92°49′W.	Black can buoy.
10.5.29	28°29′N.	88°39′W.	Tree trunk about 50 feet long with roots projecting about 5 feet out of water.
16.5.29	28°47′N.	92°05′W.	Log about 40 feet long and 2 feet in diameter.
	NORTH PACIFIC.		
2.5.29	8°06′N.	83°26′W.	Tree trunk about 60 feet long and 2 feet in diameter with roots projecting 2 feet out of water.
3.5.29	32°45′N.	124°05′W	Log about 7 feet long and 4 feet in diameter, covered with marine growth.

NAUTICAL OFFICERS AND AGENTS OF THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE, AIR MINISTRY.

LONDON ... ... Captain L. A. BROOKE SMITH, R.D., R.N.R., Marine Superintendent.
Commander J. Hennessy, R.D., R.N.R., Senior Nautical Assistant.
Room 319, Adastral House, Kingsway, W.C.2.
(*Telephone No.: Holborn 3434 Extension 421*).
Nearest station Temple, District Railway.
Mr. W. T. GRIEVES, Visiting Officer for the Port of London.

LIVERPOOL ... Lieut. Commander M. CRESSWELL, R.N.R., Port Meteorological Officer, Dock Office.
(*Telephone No.: Bank 8959*).

Agents.

BELFAST ... ... Captain J. MCINTYRE, Harbour Master, Harbour Office.
(*Telephone No.: Belfast 4090*).

CARDIFF ... ... Captain T. JOHNSTON, Technical College, Cathays Park.
(*Telephone No.: Cardiff 6813*).

CLYDE ... ... Captain M. C. CORRANCE, Board of Trade Surveyor's Office, 73, Robertson Street, Glasgow.
(*Telephone No.: Central 2283-4*).

FREMANTLE, W. Australia. Captain J. J. AIREY, Deputy Director of Navigation, Customs House.
(*Telephone No.: B 1391*).

Agents (*contd.*).

HONG KONG, China. Lieut. Commander J. H. DRUMMOND, D.S.C., R.N., Superintendent, Admiralty Chart and Chronometer Depot, H.M. Dockyard.
(*Telephone No.: 108 Dockyard*).

HULL ... ... Captain A. M. BROWN, Ellerman Wilson Line, Office. (*Telephone No.: Central 2180*).

LEITH ... ... Captains G. BLACK and C. G. BONNER, V.C., D.S.C., Leith Salvage and Towage Co., Ltd., 2, Commercial Street.

SOUTHAMPTON Captain D. FORBES, Nautical Academy, 1, Albion Place.

SYDNEY, New South Wales. Commander G. D. WILLIAMS, D.S.O., R.D., R.N.R., Deputy Director of Navigation.
Captain C. LINDBERGH.
Customs House.
(*Telephone No.: B 6421*).

TYNE ... ... Captain J. J. MCEWAN, Marine School, South Shields.

VANCOUVER, British Columbia. Mr. T. S. H. SHEARMAN, 61, Exchange Building, 553, Granville Street.
(*Telephone No.: Seymour 3309*).

The following is a complete list of ships regularly contributing observations to the Meteorological Office.

The names of the Captains and Officers, as ascertained from logs and reports received, are given with the date and description of last log, register or report received up to the time of going to press.

Marine Observers are requested to take this as complete and grateful acknowledgment for the work they have contributed, as it has been found necessary to reduce as far as possible the correspondence of the Marine Superintendent, which was largely composed of letters acknowledging logs and reports, in order that more time may be devoted to obtaining results from the data received.

Only in special cases will individual letters be sent.

Excellent awards will be made at the end of the financial year. The names of Commanders and Officers gaining these awards will be published in a special list in THE MARINE OBSERVER.

Ships not contributing logs or reports within a reasonable period will automatically be removed from the list and the free issue of THE MARINE OBSERVER discontinued; it is, therefore, earnestly requested that changes of service, probable periods of lay up or transfer of Commanders may be notified whenever possible.

A waiting list is kept of the names of vessels whose Commanders have offered to regularly co-operate.

The number of voluntary observing ships is limited to a maximum total of 500.

Commanders are requested to point out any errors which may occur in the list.

Explanation of Abbreviations.

Unless otherwise stated, vessels on the following list are s.s.—M.V. indicates Motor Vessel.

M.L. = Equipped with tested Instruments lent by the Meteorological Office for keeping Meteorological Logs.

W.T. = Equipped with tested Instruments lent by the Meteorological Office for making coded W/T reports to Weather, London.

No. = No Meteorological Office instrumental equipment on board.

M = Ship's barometer *mercurial.*

A = Ship's barometer *aneroid.*

C.C. = Equipped with tested Instruments lent by the Meteorological Office for making Cross Channel Telegraphic Reports to Weather, London.

To indicate the nature of the wireless apparatus of Selected Ships—

†† preceding ship's name indicates fitted for long range continuous wave transmission and reception.

*† = Short range transmission and long range continuous wave reception.

** = Short range transmission and reception.

The numbers preceding the names of ships are for identification purposes, when observations are re-transmitted in synoptic messages by wireless or cable, and are not intended for use at sea.

Selected Ships.

Those ships in this list which have the letters M.L., W.T. or M. after their names in the equipment column are "Selected ships" invited to make by W/T, standard form reports of observations taken at arranged G.M. Times to "All Ships." See "Wireless and Weather an aid to Navigation."

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received.
Abinsi	Millson, H. E.	H. Butler	No. A.	Elder Dempster	Form 911 20.2.29 to 31.3.29	15.4.29
†† *Accra*	Wright, J. B.	R. Jones, R. B. Ellis, B. C. Haigh, S. H. Griffiths.	„ M.	„ „	Met. Log. 13.2.29 to 1.5.29	9.5.29
*† *Achilles*	Williams, D. T.	A. G. Phillips, N. Anderson, F. W. Hilton.	M L.	A. Holt	„ 1.12.28 to 13.4.29	16.5.29
*† *Actor*	Haylett, E.	E. Pearce, F. M. Eales, G. Morrice.	„	Harrison	„ 27.8.28 to 9.11.28	22.11.28
†† *Adda*, M.V.	Toft, J. T.	A. E. Lovgreen, J. B. Wright, A. J. Kennedy.	No. M.	Elder Dempster	„ 30.1.29 to 15.4.29	25.4.29
††50 *Adriatic*	Hickson, V. W., R.D., Lt.-Commr. R.N.R.	O. V. Lucas, H. R. Wilkinson, D. W. Chamberlain.	W.T.	White Star	W T. Reg. 7.4.29 to 27.4.29 Form 911 7.4.29 to 27.4.29	30.4.29 29.4.29
Aeneas	Wallace, W. K.	D. R. Bannerman	No. A.	A. Holt	„ 18.12.28 to 28.2.29	5.3.29
Agapenor	Ramsay, J.	B. Bell	„ A.	„	„ 3.4.29 to 19.4.29	29.4.29
Aidan	Evans, L.	N. Caris	„ A.	Booth	„ 14.2.29 to 4.4.29	12.4.29
Alban	Buck, R. H.	G. M. Duff	„ A.	„	„ 26.10.28 to 24.2.29	15.3.29
*† *Alipore*	Dawson, E. E. N.	H. R. W. Page	„ M.	P. and O.	„ 11.3.29 to 26.3.29	29.4.29
Almanzora	Clarke, E. C.	...	„ A.	R.M.S.P.	„ 21.3.29 to 6.5.29	16.5.29
††63 *Albertic*	Summers, F. F., R.D., Commr., R.N.R.	W. F. Dennison, W. Hill, R. H. Shaw.	W T.	White Star	W.T. Reg 2.4.29 to 21.4.29 Form 911 3.3.29 to 24.3.29	24.4.29 26.3.29
Alondra	Scott, L. S.	H. Peters	No. A.	Yeoward	Form 911 6.4.29 to 27.4.29	30.4.29
Alynbank	Clayton, W. E.	R. A. B. Ardley	„ A.	A. Weir & Co.	„ 11.3.29 to 24.3.29	22.4.29
†† *Andalucia*	Thomas, R. J.	H. Austen	„ M.	Blue Star	Form 911 27.1.29 to 11.3.29	18.3.29
Anchises	Woodgett, R. J.	R. Fountain, T. Coyne	„ A.	A. Holt	„ 18.1.29 to 4.2.29	13.2.29
†† *Andes*	Smith, W. E., D.S.O., R.D., Capt., R.N.R.	H. Whittle, H. Sang, A. Nicholls, R. N. Mayo.	M.L.	R.M.S.P. Co.	Met. Log. 27.10.28 to 6.2.29	18.2.29
Antillian	Hannaford, W. T.	...	No. A.	Leyland	Form 911 11.5.28 to 24.7.28	26.7.28
Antilochus	Salter, G. H.	A C. Abbott	„ A.	A. Holt	„ 18.1.29 to 10.3.29	19.3.29
*† *Aorangi*	Crawford, R. Hill, T. V.	E. V. Bilger, R. Kendall, E. M. Anderson, D. Richards.	M.L.	Canadian-Australasian	Met. Log. 17.10.28 to 31.1.29	12.3.29
††30 *Aquitania*	Prothero, W.	R. W. Bee, J. Locke, G. Duguid.	W.T	Cunard	W.T. Reg. 7.4.29 to 23.4.29 „ 14.3.29 to 29.3.29	25.4.29 2.4.29
††62 *Arabic*	Bulman, J. B.	W. Hesketh, F. Wills, C. Clarke.	„	White Star	„ 1.4.29 to 20.4.29	23.4.29
** *Arafura*	Gordon, A. S.	F. R. Miller, B. W. Dun, C. Stratford.	M.L.	Eastern and Australian	Met. Log. 4.5.28 to 2.11.28	21.12.28
*† *Argyllshire*	Wallace, J.	R. W. Cook	No. M.	Federal	Form 911 9.3.29 to 15.4.29	7.5.29
*† *Ariguani*	Scudamore, J. H. H., D.S.C., R.D., Commr., R.N.R.	G. McKee. J. W. Dodd, W. Ireland.	M.L.	Elders & Fyffes	Met. Log. 15.12.28 to 14.4.29	26.4.29
Ariosto	Biggins, R. L.	...	No A.	Ellerman Wilson	Form 911 17.12.28 to 29.12.28	4.2.29
†† *Armadale Castle*	Knight, A.	...	M.L.	Union Castle	Met. Log. 7.9.28 to 3.3.29	11.3.29
*† *Arracan*	Macfarlane, W. M. F.	J. Henderson, J. Morrison, F. Scott.	„	P. Henderson	„ 18.10.28 to 7.3.29	27.3,29
Arundel	Short, H.	Mr. Hill	C.C.	Southern Rly.	Telegraphic Report 4.4.29	4.4.29
Arundel Castle	Owen, S. H.	P. Clissold.	No. A,	Union Castle	Form 911 8.2.29 to 31.3.29	4.4.29
*† *Astronomer*	Richards, J.	A. Frew, E. B. Stephens, W. B. Littlechild.	M.L.	Harrison	Met. Log. 5.9.28 to 31.1.29	14.2.29

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received.
*† *Ascanius*	Wilson, C. A.	T. Robb, E. M. Robb. W. H. Elliott.	M.L.	A. Holt	Met. Log. 28.10.28 to 1.3.29	18.3.29
Atreus	Wilkinson, T. G.	H. Nicholas	No. A.	A. Holt	Form 911 28.4.29 to 7.5.29	16.5.29
*† *Auditor*	Owen, W. T.	D. O. Percy	„ M.	Harrison	„ 23.12.28 to 9.2.29	19.2.29
Autolycus	Dunlop, J. K.	... ...	„ A.	A. Holt	„ 25.10.28 to 11.11.28	28.11.28
Balmoral Castle	J. H. Kerbey	H. A. Deller	„ A.	Union Castle	„ 8.3.29 to 28.4.29...	11.5.29
*† *Balranald*	Townshend, W. P., Capt., R.N.R.	H. Stinn, G. Owen, F. Ward, L. Bailey.	„ M.	P. & O. Branch	Met. Log. 13.9.28 to 10.1.29	23.1.29
††51 *Baltic*	Warner, G. E., R.D., Capt., R.N.R.	A. C. I'Anson, J. C. Boyce, J. K. Crawford.	W.T.	White Star	W.T. Reg. 25.3.29 to 13.4.29 „ 22.4.29 to 11.5.29 Form 911 25.3.29 to 11.5.29	17.4.29 15.5.29 14.5.29
Bampton Castle	Hutchings, A. H.	E. Hamlyn	No. A.	Union Castle	„ 28.4.28 to 4.8.28	23.8.28
*† *Banffshire*	Westropp, T. G.	A. Mc L. Pilcher	„ M.	Turnbull Martin	„ 1.2.29 to 23.2.29...	2.4.29
*† *Baradine*	Rollo, W.	C. B. Roche, B. H. Pollitt, P. Haworth, J. H. Anderson.	M.L.	P. & O. Branch	Met. Log. 19.7.28 to 20.11.28	22.11.28
*† *Barpeta*	Rudge, J. G. Chandler, H. V.	N. Apps	No. M.	British India	Form 911 13.2.29 to 31.3.29	25.4.29
*† *Barrabool*	Rhodes, H. R.	T. G. Davies	„ M	P. & O. Branch	„ 11.1.29 to 28.1.29	5.3.29
*† *Barranca*	Edwards, A. C.	... ...	M.L.	Elders & Fyffes	... ...	...
Baychimo	Cornwall, S. A.	... ...	„ A	Hudson's Bay Co.	„ 5.10.28 to 19.11.28	3.12.28
††59 *Belgenland*	Morehouse, W. A.	F. Good, C. H. Otterson, F. Clitty.	W.T.	Red Star	W.T. Reg. 5.5.29 to 11.5.29 Met. Log. 18.12.28 to 1.5.29	16.5.29 16.5.29
*† *Beltana*	Rollo, W.	G. V. Legassick.	No. M.	P. & O. Branch	Form 911 10.2.29 to 1.3.29...	25.3.29
Benalder	Fairweather, J. J.	D. T. McCullum	„ A.	Ben Line	„ 31.1.29 to 1.4.29...	12.4.29
*† *Benalla*	Sheepwash, J. H.	D. E. C. Otter	„ M.	P. & O. Branch	„ 17.2.29 to 8.3.29	15.4.29
†† *Bendigo*	Nicholl, R. N. C.	G. G. Mason	„ M.	„ „	„ 9.8.28 to 28.9.28	3.10.28
*† *Benefactor*	Jones, C. W.	S. M. Smith, R. Huntingdon.	„ M.	Harrison	„ 4.2.29 to 4.3.29 ...	2.4.29
Bengloe	McCorquodale, A.	G. Davidson	„ A.	Ben Line	„ 11.4.28 to 21.5.28	8.6.28
††31 *Berengaria*	Rostron, Sir A. H., K.B.E., R.D., Capt. R.N.R.	J. A. Myles, S. A. T Bullock	W.T.	Cunard	W.T. Reg. 14.4.29 to 30.4.29	2.5.29
*† *Berrima*	Short, C. E.	G. H. Durrant	No. M.	P. & O. Branch	Form 911 25.5.28 to 3.6.28	27.8.28
Brenda	Lamont, A.	N. Ross	„ A.	Scottish Fishery Brd.	„ 1.4.29 to 28.4.29...	2.5.29
Brighton	Hill, A.	Mr. Munton	C.C.	Southern Railway	Telegraphic Report 11.5.29	11.5.29
*† *British Dominion*	Taylor, R. J.	... ...	No. M.	British Tankers	... ...	...
*† *British Merchant*	Putt, R. O.	... ...	„ M.	„ „	... ...	...
Bronte	Crapper, J. S.	J. B. Scott	„ A	Lamport & Holt	Form 911 25.3.28 to 26.4.28	8.6.28
Bruyere	Birch, A.	... ...	„ A.	„ „	„ 27.11.28 to 24.2.29	4.3.29
*† *Bulysses* M.V.	Head, B. P.	A. J. Clatworthy, J. S. Pike.	„ M.	Anglo-Saxon Petroleum Co.	„ 24.1.29 to 11.3.29	15.3.29
*† *Buteshire*	Page, W. J	... ...	M.L.	Turnbull Martin	... ...	...
††65 *Calgaric*	Binks, J. W., R.D, Lt.-Commr. R.N.R.	G. Kavanagh	W.T.	White Star	„ 5.3.29 to 11.5.29 W.T. Reg. 22.4.29 to 10.5.29	15.5.29 15.5.29
Cambria	Copland, C. P.	O. W. Ll. Jones	C.C.	L.M. & S. Rly	Telegraphic Report 15.5.29	15.5.29
*† *Cambridge*	Williams, R.	... ...	M.L.	Federal	... ...	...
†† *Cameronia*	Gemmell, W.	D. Chamberlain	M.L.	Anchor	Met. Log. 28.4.28 to 15.9.28	6.11.28
†† *Camito*	Forrester, W. T. O.B.E.	H. H. Dunning, W. E. Grant, G. M Roberts.	„	Elders & Fyffes	„ 11.10.28 to 8.3.29	13.3.29
Canadian Importer	Forson, A.	E. Hamilton	No. A.	Canadian Gov. Mercantile Marine.	Form 911 19.3.29 to 16.4.29	7.5.29
** *Canadian Winner*	McConechy, W. G.	J. M. Lang	„ M.	„ „ „	„ 17.9.28 to 13.10.28	27.11.28
*† *Canonesa*	Brodie, W. H.	T. Wetherall	„ M.	Furness Houlder	„ 25.2.29 to 25.3.29	4.4.29
Cape of Good Hope	Lamont, J.	W. S. Bartlett	No. A.	Lyle S.S. Co.	„ 30.1.29 to 11.3.29	2.4.29
††35 *Carmania*	Brown, F. G., R.D., Capt., R.N.R.	W. M. Stewart, E. R. Taylor, E. Gleave.	W.T.	Cunard	W.T. Reg. 29.10.28 to 17.11.28	20.11.28
†† *Carnarvon Castle* M.V.	Stanley, W. F., R.D., Commr., R.N.R.	W. G. Smith, T. C. Goldstone, S. S. Smith.	M.L.	Union Castle	Met. Log. 14.7.28 to 4.11.28	26.11.28
††34 *Caronia*	Hossack, W. H., R.D., Capt., R.N.R.	T. Parry, E. R. B. Freeman, S. E. Clowser.	W.T.	Cunard	W.T. Reg. 15.4.29 to 3.5.29... Form 911 15.4.29 to 3.5.29...	7.5.29 7.5.29
Casanare	Browne, S.	... ...	No. A.	Elders & Fyffes	„ 9.3.29 to 14.4.29	20.4.29
†† *Cathay*	Griffin, R, H., O.B.E., R.D., Capt. R.N.R.	... ...	„ M.	P. & O	... ...	...
Cavina	Riseley, A. D.	R. C. Harradon	„ A.	Elders & Fyffes	Form 911 9.4.29 to 11.5.29	14.5.29
††52 *Cedric*	Hulme, R.	J. H. Walker, W. Nicoll, J. Law.	W.T.	White Star	W.T. Reg. 15.4.29 to 5.5.29... Form 911 14.4.29 to 5.5.29...	9.5.29 7.5.29
*† *Centaur*	Ward Hughes, J.	N. L. Thompson, J. Cockburn, B. L. Brind.	M.L.	A. Holt & Co.	Met. Log. 16.7.28 to 14.12.28	18.2.29
Ceramic	Musgrave, T.	H. A. R. Daman	No. A.	White Star	Form 911 15.2.29 to 1.3.29	8.4.29
** *Changte*	Gambrill, F. C.	T. Tyer, D. Baigent, D. H. O'Hulton.	M.L.	Yuill & Co.	Met. Log. 1.9.28 to 17.1.29...	20.3.29
Changuinola	Thorburn, R. A., R.D., Commr., R.N,R.	B. R. Coe	No. A.	Elders & Fyffes	Form 911 22.3.29 to 24.4.29	25.4.29
Chindwin	Paterson, G.	... ...	„ A.	Henderson	„ 26.11.28 to 7.2.29	8.3.29
*† *Chirripo*	Sapsworth, S. A.	S. J. Jackson	„ A.	Elders & Fyffes	„ 13.3.29 to 12.4.29	17.4.29
*† *City of Baroda*	McMillan, J.	J. E. Jenkins, W Faichney, F. T. Mallett.	M.L.	Ellerman	Met. Log. 1.1.29 to 22.4.29...	30.4.29
City of Benares	Anderson, W. W.	P. C. Wilson	No. A.	„	Form 911 5.11.28 to 16.2.29	13.3.29
*† *City of Bombay*	Brown, O. C.	E. H. Roberts	„ M.	„	„ 16.1.29 to 7.4.29...	12.4.29
*† *City of Bristol*	Jenkins, D.	K, G. Crockett	„ M.	„	„ 11.11.28 to 1.12.28	7.1.29
City of Canterbury	Stanley, A.	R. H. Hodgson	„ A.	Ellerman	„ 17.2.29 to 19.3.29	8.4.29
City of Carlisle	Mordue, J. A.	... ...	„ A.	„	„ 10.4.29 to 21.4.29	1.5.29
*† *City of Chester*	Letton, F. W.	C. C. Duncan, P. C. Arthur, M. J. Mc Nicol.	M.L.	„	Met. Log. 7.10.28 to 13.2.29	25.2.29
City of Hong Kong	Walton, H. L., O.B.E., R.D., Commr., R.N.R.	H. Saunders	No. A.	„	Form 911 31.3.29 to 9.4.29...	29.4.29
City of Khios	Reay, A. S.	R. E. Thornton	„ A.	„	„ 19.2.29 to 10.3.29	2.4.29
City of London	Nicoll, L.	... ...	No. A.	„	Form 911 2.2.29 to 17.4.29...	3.5.29
*† *City of Osaka*	Smith, W. H.	R. K. Walker	No. M.	„	„ 29.3.29 to 10.4.29	1.5.29
*† *City of Rangoon*	Jones, P.	E. R Wildermuth, R. H. Stewart, F. E. Broadbent.	M.L.	„	Met. Log. 28.3.28 to 9.7.28	1.8 28
City of Yokohama	Singleton, J. G.	H. Nish	No. A.	„	Form 911 16.2.29 to 24.2.29	23.4.29
Clan Alpine	Lyall, A. B.	P. Sargent	„ A.	Clan	„ 21.12.28 to 14.2.29	18.2.29
Clan Kenneth	Young, A. H., Commr. R.D., R.N.R.	... ...	„ A.	„	„ 3.11.28 to 28.11.28	1.1.29
Clan Lindsay	Giles, H. J., R.D., Commr., R.N.R.	J. P. Dunkley	„ A.	„	„ 25.1.29 to 24.2.29	5.3.29
Clan MacBean	Worthington, J. H.	W. A. Nicholas	„ A.	„	„ 20.2.29 to 6.3.29	15.4.29
Clan Macbeth	Hannay, L. G.	J. C. Robertson	„ A.	„	„ 20.1.29 to 1.2.29	20.2.29
Clan Macfadyen	Laird, C.	R. L. Smallbone	„ A.	„	„ 24.3.29 to 16.4.29	30.4.29
Clan Macfarlane	Redford, L. F.	T. A. Pearson	„ A.	„	„ 28.10.28 to 14.12.28	21.1.29

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received.
Clan Macgillivray	Mackinlay, A.	F. H. Thornton	No. A.	Clan	Form 911 11.1.29 to 30.1.29	26.2.29
Clan Macindoe	Holman, W. G.	...	„ A.	„	„ 17.8.28 to 19.9.28	26.9.28
Clan Mackellar	Smith, W. P.	E. Crowther	„ A.	„	„ 16.12.28 to 16.3.29	22.3.29
** *Clan Macphee*	Gourlay, J. B.	E. H. Stone, K. C. Simpson, L. R. Legg.	M.L.	„	Met. Log. 11.6.28 to 12.12.28	28.1.29
Clan Macnaughton	Clark, J.	A. H. Hersee	No. A.	„	Form 911 18.3.29 to 30.3.29	10.4.29
Clan Macquarrie	West, W. F.	T. P. Cranwill	„ A.	„	„ 5.1.29 to 7.2.29	12.2.29
Clan Mactaggart	Higgins C. J.	D. McAllister	„ A.	„	„ 5.3.29 to 28.3.29	22.4.29
** *Clan Macwhirter*	Low, A.	F. B. Barker, H. M. Watkins	M.L.	„	Met. Log. 16.6.28 to 16.1.29	11.2.29
** *Clan Malcolm*	George, L. S.	J. Masters, R. L. Ranford, J. F. Hubbard, R. L. Martin.	„	„	„ 7.7.28 to 21.10.28	19.11.28
Clan Morrison	Porterfield, W. M. Lt.-Commr., R.N.R.	L. C. Cuthbert	No. A.	„	Form 911 4.4.29 to 28.4.29	10.5.29
Clan Murdoch	Calderwood, W.	J. B. Davies	„ A.	„	„ 2.3.29 to 23.3.29	16.4.29
Clan Ranald	Fraser, R. K.	K. G. Tucker	„ A.	„	„ 16.2.29 to 6.4.29	13.5.29
Clan Ross	Neill, G. A.	A. G. Beynon	„ A.	„	„ 17.3.29 to 11.4.29	26.4.29
Clan Sinclair	Taylor, P. V.	J H. Dennis	„ A	„	„ 17.3.29 to 29.3.29	8.4.29
*† *Colonial*	Worthington, B.	A. S. Milne	„ M.	T. & J. Harrison	„ 18.9.28 to 23.3.29	6.4.29
†† *Comorin*	Borland, J. Mc.I., C.B., D.S.O., R.D., Capt., R.N.R.	E. C. White	„ M.	P. & O.	„ 26.12.28 to 7.2.29	22.2.29
†† *Corinthic*	Freeman, C. P.	E. M. Burt, M. Bennett, I. A. Macnaughton.	M.L.	White Star	Met. Log. 8.12.28 to 26.3.29	8.4.29
Cornwall	Lamb, C. B.	C. R. Brown	No. A.	Federal	Form 911 10.12.28 to 17.1.29	18.3.29
Crawford Castle	Conley, E. A.	...	„ A.	Union Castle	...	...
*† *Culebra*	Goble, C. J., R.D., Commr., R.N.R	H. D. Cooper, R. N. Fletcher, W. S. Thomas.	M.L.	R.M.S.P. Co.	Met. Log. 6.1.29 to 13.3.29	1.4.29
*† *Cumberland*	Macmillan, D.	P. Shakespear, F. Loughead, T. Shillito, J. Lennox.	„	Federal	„ 29.10.28 to 29.3.29	5.4.29
Cyclops	Cosker, W.	C. B. P. Anderson	No. A.	A. Holt	Form 911 4.4.29 to 23.4.29	11.5.29
*† *Daga*	Wiles, N.	A. Olding	„ M.	P. Henderson	„ 16.11.28 to 9.12.28	22.12.28
Dakotian	Robb, J.	H. Arnold	„ A.	Leyland	„ 20.1.29 to 26.3.29	3.4.29
Dardanus	Glossop, S.	R. W. Ellis	„ A.	A. Holt	„ 16.3.29 to 31.3.29	10.4.29
†† *Darro*	Turner, E. H.	...	„ M.	R.M.S.P. Co.	„ 9.3.29 to 25.4.29	3.5.29
Delilian	Fulford, S. S., R.D., Commr. R.N.R.	...	„ A.	Leyland	...	...
*† *Delphic*	Evans, W.	H Williams	„ M.	White Star	„ 31.12.28 to 17.1.29	29.1.29
*† *Delta*	Townshend, W. P., R.D., Capt., R.N.R.	D. M. Stafford	„ M.	P. & O.	„ 11.3.29 to 30.3.29	13.5.29
†† *Demerara*	Willan, F. G. L., R.D., Capt., R.N.R.	J. C. Blake	„ M.	R.M.S.P. Co.	„ 5.2.29 to 27.3.29	2.4.29
†† *Demosthenes*	Ogilvy, A.	S. A. Ferguson	„ M.	Aberdeen Commonwealth	„ 6.2.29 to 17.3.29	29.4.29
Denis	Harris, F. C. P.	J. H. Stokes	„ A.	Booth	„ 6.12.28 to 25.2,29	6.4.29
†† *Deseado*	F. S. Hannam	A. Barff	„ M.	R.M.S.P. Co.	„ 16.3.29 to 10.5.29	14.5.29
†† *Desna*	Green, J.	L. T. Peterson	„ M.	„	„ 3.9.28 to 24.10.28	12.11.28
Deucalion	Melling, C. F.	R. F. Dryden	„ A.	A. Holt	„ 22.3.29 to 8.4.29	29.4.29
*† *Devon*	Kinnell, G.	S. C. Bradley	„ M.	Federal	„ 5.3.29 to 22.4.29	6.5.29
Dieppe	Marmery, S.	Mr. Parsons	C.C.	Southern Railway	Telegraphic Report 16.5.29	16.5.29
Dimboola	Dawson, J.	S. J. Griffith	No. A.	Melbourne S.S. Co.	Form 911 15.2.29 to 10.4.29	13.5.29
*† *Domala*, M.V.	Kitson, A. G.	H. Robertson	„ M.	British India	„ 21.10.28 to 29.12.28	14.1.29
†† *Dominia*, C.S.	Campos, V., O.B.E., Lt.-Commr., R.N.R.	S. A. Garnham, A. S. Muir, L. J. Hegarty. W. F Anderson.	M.L.	Telegraph Construction & Maintenance.	Met. Log. 8.8.28 to 5.12.28	27.12.28
Dominic	Saxton, C.	G. H. Clark	No. A.	Booth	Form 911 6.1.29 to 4.4.29	10.4.29
†† 61*Doric*	Binks, J. W., R. D., Lt.-Commr., R.N.R.	F. E. Patchett, J. Farrell, S. A. Jones.	W.T.	White Star	„ 24.3.29 to 14.4.29 W.T. Reg. 24.3.29 to 13.4.29	20.4.29 23.4.29
Dorington Court	Clarke, E. J.	P. Jones	No. A.	Haldin & Co.	Form 911 7.1.29 to 14.2.29	16.3.29
Dromore Castle	MacMahon, J., R.D., Commr., R.N.R.	J. A. Sowden	„ A.	Union Castle	„ 3.11.28 to 1.12.28	1.1.29
*† *Dryden*	Major, T. W.	...	„ M	Lamport & Holt	„ 21.10.28 to 14.1.29	7.2.29
Dunaff Head	Butt, H. L., R.D., Lt.-Commr., R.N.R.	D. Martin	„ A.	Ulster S.S. Co.	„ 22.1.29 to 6.2.29	18.2.29
Dunluce Castle	Jackson, C. R.	H. Colwill	„ A.	Union Castle	„ 11.4.29 to 2.5.29	7.5.29
Dunrobin	Ramsay, J. D.	C. H. Kendall	„ A.	Glen & Co.	„ 14.4.29 to 23.4.29	26.4.29
*† *Duquesa*	Barker, A. W.	J. G. Freeman	„ M.	Furness Withy	„ 13.1.29 to 14.3.29	19.3.29
*† *Durenda*, M.V.	Beeching, P. H.	J. E. Miles	„ M.	British India	„ 6.3.29 to 24.3.29	19.4.29
Edinburgh Castle	Gardner, G.F., O.B.E., Lt.-Commr., R.N.R.	C. P. Goode	„ A.	Union Castle	„ 25.1.29 to 17.3.29	21.3.29
Egori	Sola, P., D.S.O.	D. M. Range	„ A.	Elder Dempster	„ 6.2.29 to 14.4.29	15.4.29
*† *El Argentino*	Ellis, F.	...	„ M.	Houlder	...	...
*† *Eldon Park*	Burns, R.	D. Rankine	„ M.	Denholm S.S. Co.	„ 5.11.28 to 9.2.29	20.2.29
*† *Elpenor*	Gordon, A. L.	E. Roberts, A. Pearson, J. E. Iliff.	M.L.	A. Holt	Met. Log. 9.12.28 to 13.4.29	22.4.29
*† *Elstree Grange*	St. Pierre, P.	...	No. M.	Houlder	...	...
*† *Elysia*	Duncan, A. R.	D. Blair, G. S. Sinclair, W. Beveridge.	M.L.	Anchor	Met. Log. 30.1.29 to 1.4.29	16.4.29
** *Empress of Asia*	Hailey, A. J., Lt.-Commr., R.N.R.	L. M. Goddard, J. F. Patrick. R. J. Hickey, E. Newell,	„	Canadian Pacific	„ 11.10.28 to 9.2.29	13.3.29
†† *Empress of France*	Robinson, S., C.B.E., R.D., Commr., R.N.R.	A. G. Simmons	„	„ „	„ 28.11.28 to 2.3.29	3.4.29
** *Empress of Russia*	Hosken, A. J.	R. A. Leicester, J. B. Smith, H. B. Metcalf, A. C. Jones.	„	„ „	„ 17.11.28 to 22.3.29	20.4.29
Endeavour	Law, E. F. B., Commr., R.N.	P. Barlow, S. J. Hennessey, W. M. Passmore, M. B. Thomas.	„	His Majesty's Ship	„ 15.11.28 to 14.3.29	8.4.29
Enterprise	Pridham-Wippell, H.D., Capt., R.N.	...	„	„ „	...	...
*† *Essequibo*	Kirkwood, J. H.	J. H. E. Evans	No. M.	R.M.S.P. Co.	Form 911 12.7.28 to 26.9.28	16.11.28
Eumaeus	Read, J. W.	D. W. Stroud	„ A.	A. Holt	„ 12.4.29 to 27.4.29	6.5.29
Euryades	Findlay, J.	W. K. Hole	„ A.	A. Holt	„ 26.1.29 to 8.3.29	6.4.29
*† *Explorer*	Ling, J. T.	H. W Gostage	„ M.	Harrison	„ 14.10.28 to 4.1.29	9.1.29
Explorer	Allan, J.	A. Stout, F. O. Sheehy	„ A.	Scottish Fishery Board.	„ 4.4.29 to 14.4.29	30.4.29
*† *Ferndale*	Thompson, W.	R. S. Hartrick	„ M.	Aberdeen Commonwealth.	„ 7.7.28 to 5.8.28	23.8.28
*† *Fordsdale*	Richardson, A. V.	F. Vaughan	„ M.	Aberdeen Commonwealth.	„ 22.2.29 to 18.3.29	4.4.29

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received
Francisco	Aspinall, A. E.	W. F. Hewetson	No. A.	Ellerman Wilson	Form 911 17.2.29 to 29.3.29	2.4.29
Freya	Angus, W.	W. Pirrie	„ A.	Scottish Fishery Board.	„ 1.4.29 to 30.4.29	4.5.29
Garth Castle	Linklater, H.	T. H. Whatley	„ A.	Union Castle	„ 1.11.28 to 29.12.28	3.1.29
** *Gascoyne*	Johnson, L.	W. J. Macphedran, C. Melson, J. S. Macbryde.	M.L.	A. Holt & Co.	Met. Log. 11.9.28 to 15.2.29	24.4.29
*† *Glamorganshire*	Purvis, A.	E. A. E. Littlewood	No. M.	R.M.S.P. Co.	Form 911 17.9.28 to 19.10.28	25.10.28
*† *Glenamoy*, M.V.	Homan, C. E.	R. W. Emerson, R. W. Brooks, J. R. Taylor.	M.L.	Glen Line	Met. Log. 25.6.28 to 7.11.28	6.12.28
Glenapp	Ingram, T. F.	...	No. A.	„	Form 911 19.1.29 to 27.2.29	2.4.29
Glenbeg	Newing, L.	A. D. Brown	„ A	„	„ 27.10.29 to 18.1.29	22.1.29
*† *Glengarry*	Angier, J.	F. C. White, D. C. Evans	„ M.	„	„ 7.3.29 to 9.5.29	13.5.29
Glenluce	Kennett, W. H.	H. B Porter	„ A.	„	„ 30.1.29 to 22.4.29	2.5.29
Glenshane	Suter, S. C.	...	„ A.	„	„ 10.11.28 to 1.4.29	6.4.29
Glentworth	Kilgour, H. A.	W. C. Wright	„ A.	R. S. Dalgleish	„ 3.3.29 to 16.4.29	10.5.29
Gloucestershire	Robin. E.	W. Moore	„ A.	Bibby	„ 1.12.28 to 8.2.29	12.2.29
Gloxinia	Pool. F. G.	D. Coughlan	„ A.	Stag Line	„ 11.2.29 to 14.3.29	10.5.29
Guildford Castle	Morgan, A. O., R.D., Commr. R.N.R.	...	„ A.	Union Castle	...	...
Halesius	Samuels, C.	N. MacLeod	„ A.	R. P. Houston	„ 6.1.29 to 4.2.29	25.2.29
Haliartius	Felton, W. J.	F. D. Bonney	„ A.	„ „	„ 13.11.28 to 8.2.29	28.2.29
*† *Hardwicke Grange*	Fowler, W. H.	...	„ M.	Houlder	„ 20.1 29 to 20.3.29	2.4.29
Harmonides	Elwell, F. R.	R. H. Pape	„ A.	R. P. Houston	„ 16.3.29 to 31.3.29	22.4.29
*† *Hatimura*	Parkin, J. W.	L. E. Heath	„ M	British India	„ 13.2.29 to 14.3.29	16.3.29
** *Hauraki*, M.V.	Norton, A. T.	D. M. McLeish, C. H. George, F. C. Cochran.	M.L	Union S.S. Co., N.Z.	Met. Log. 17.4.28 to 25.10.28	4.1.29
** *Henry Holmes*, C.S.	Bicker Caarten, A.	M. A. Green	No. M	W. I. & Panama Telegraph Co.	Form 911 13.10.28 to 31.10.28	3.12.28
Herald	Turner, H. E., Lieut.-Commr.	W. H. Martin	M.L.	His Majesty's Ship	Met. Log. 31.10.28 to 28.11.28	9.1.29
Herminius	Roberts, T. V.	D. W. MacGregor	No. A.	Aberdeen Commonwealth.	Form 911 17.1.29 to 2.3.29	12.4.29
Herschel	Watson. W. W.	...	„ A.	Lamport & Holt	„ 13.1.29 to 18.4 29	20.4.29
Hesione	McComish, A. B.	...	No.	R. P. Houston	...	...
Hibernia	Roberts. W. Ivor, M.B.E.	R. Woodall, A. Marsh	C.C.	L.M. & S. Railway	Telegraphic Report 11.5.29	11.5.29
*† *Highland Chieftain*, M.V.	Robinson. R. H.	Cables, J. H.	No. M.	Nelson	...	...
Highland Laddie	Jones. T. J.	E. F. Smart	„ A.	„	Form 911 22.4.28 to 12.6.28	9.7.28
*† „ *Piper*	Collings, D.	R. G. Owen, A. Southgate, W. Stephen.	M.L.	„	Met. Log. 23.6.28 to 10.1.29	21.1.29
„ *Pride*	Robinson, R. H.	F. Quelch	No. A.	„	Form 911 8.9.28 to 3.11.28	7.11.28
„ *Prince*	Taylor, F.	W. A. Hall	„ A.	Prince	„ 30.3.29 to 11.4.29	25.4.29
„ *Rover*	McKinnon, H.	E. Smart	„ A.	Nelson	„ 1.1.29 to 18.2.29	11.3.29
Hildebrand	Peregrine. D.	D. S. Davies	„ A.	Booth	„ 13.3.29 to 24.4.29	30.4.29
*† *Hobson's Bay*	Kydd, O. J.	R. Pearce, J. Worrall, D. Horn, R. S. Winnall.	M.L.	Aberdeen Commonwealth.	Met. Log. 30.10.28 to 11.2.29	5.3.29
Holbein	Gough, W. A.	F. Delaney	No. A.	Lamport & Holt	Form 911 6.1.29 to 17.3.29	2.4.29
††54 *Homeric*	White, E. R., R.D., Commr. R.N.R.	H. G. Morgan. S. B. Morfee, W. T. Poustie.	W.T.	White Star	W.T. Reg. 4 4.29 to 19.4.29 „ 25.4.29 to 10.5.29	22.4.29 14.5.29
Hororata	Barnett, H.	E. A. Quick	No. A.	New Zealand S.S. Co.	Form 911 17.1.29 to 8.2.29	18.3.29
Hubert	Briscoe, W.	G. G. Westhorp	„ A.	Booth	„ 2.1.29 to 1.3.29	22.3.29
Huntingdon	Field, H. G. B.	H. G. Letts	„ A.	Federal	„ 16.2.29 to 5.3.29	25.3.29
*† *Huntsman*	Russell, H.	J. Richardson	„ M.	Harrison	„ 13.4.28 to 15.8.28	3.9.28
*† *Hydaspes*	Williams, P. E.	P. McMillan	„ M.	R. P. Houston	„ 27.3.29 to 24.4.29	2.5.29
*† *Ingoma*	Gibbings, W.	W. E. Williams	„ M.	Harrison	Form 911 23.3.29 to 2.5.29	6.5.29
Inkum	Meethan, J. T.	...	„ A.	J. H. Welsford	„ 10.10.28 to 24.10.28	3.11.28
** *Iris*, C.S.	Hughes, H. P.	D. MacDonald, T. Vickers, J. Hare, G. Holthouse	M.L.	Pacific Cable Board	Met. Log. 23.2.28 to 10.1.29	15.3.29
Iroquois	Nares, J. D., D.S.O., Capt. R.N.	A. B. Fouleston	„	His Majesty's Ship	„ 1.9.28 to 30.11.28	8.1.29
*† *Ixion*	Collins, H. M.	...	„	A. Holt	Form 911 9.10.28 to 26.10.28	19.12.28
Javanese Prince	Marshall, F.	J. B. Morrison	No. A.	Prince	„ 19.1.29 to 15.2.29	18.3.29
*† *Jeypore*	Cooper, C. P., O.B.E., R.D Capt. R.N.R.	...	„ M.	P. & O.	„ 7.3.29 to 3.4.29	6.5.29
Justin	Bush, H.	J. Stretch	„ A.	Booth	„ 15.2.29 to 9.4.29	22.4.29
†† *Kaisar-i-Hind*	Manley, G.	R. H. Hand	„ M.	P. & O.	„ 2.2.29 to 28.3.29	6.4.29
*† *Kalyan*	Cornewall Jones, B.	W. R. B. Noal	„ M.	P. & O.	„ 9.3.29 to 21.4.29	10.5.29
** *Kangaroo*	Norris, H. C.	E. Hutchinson, J. Edward, H. Reynolds.	M.L.	State Service Australia.	Met Log. 2.4.28 to 1.8.28	29.10.28
*† *Karamea*	McIntosh, A.	...	„	Shaw, Savill & Albion	„ 15.9.28 to 17.1.29	23.1.29
*† *Karapara*	Miller, A. C.	J. Smail	No. M.	British India	Form 911 11.3.29 to 29.3.29	22.4.29
*† *Kashgar*	Northcote, H. B., R.D., Commr.. R.N.R.	R. P. Eddy	„ M.	P. & O.	„ 12.2.29 to 22.3.29	26.3.29
*† *Kashmir*	Bent. E.	...	„ M.	P. & O.	Form 911 19.10.28 to 4.1.29	17.1.29
*† *Khandalla*	Baird, S.K.	...	„ M.	British India	...	...
*† *Khiva*	Britten, P. O.	C. E. Arundel, J. A. Ridley, H. V. Williamson.	M.L.	P. & O.	Met. Log. 10.1.29 to 20.4.29	26.4.29
*† *Knight Companion*	Davis, A. L.	J. H. Isherwood	No. M.	A. Holt	Form 911 24.2.29 to 15.3.29	27.3.29
** *Koolinda*, M.V.	Buckeridge, J. Kavanagh, J.	...	„ M.	State Service, Australia.	„ 24.7.28 to 6.9.28	15 10.28
††37 *Laconia*	Doyle, M.	E. W. Connell, A. B. Fasting, F. G. Russell	W.T.	Cunard	W.T. Reg. 4.4.29 to 12.4.29 „ 21.4.29 to 12.5.29 Form 911 29.3.29 to 12.5.29	16.4.29 16.5.29 15 5.29
Laguna	Dunn, R. E., O.B.E.	R. W. Hanson	No. A.	Pacific S.N. Co.	„ 9.4.29 to 28.4.29	1.5.29
*† *Lahore*	Gordon, L. M., R.D., Commr. R.N.R.	E. B. Elcoate	„ M.	P. & O.	„ 15.5.28 to 29.6.28	12.7.28
Lalande	Hamill, H.	...	„ A.	Lamport & Holt	„ 30.10.28 to 27.1.29	7.2.29
Lancashire	de Legh, P.	R. Allen	„ A.	Bibby	„ 29.12.28 to 6.3.29	11.3.29
††36 *Lancastria*	Townley, J. C. R.D., Commr., R.N.R.	G. Overton, P. L. Williams, J. W. Caunce.	W.T.	Cunard	W.T. Reg. 11.3.29 to 12.3.29 „ 22.4.29 to 11.5.29 Form 911 21.4.29 to 11.5.29	2 4.29 16.5.29 15.5.29
Laomedon	Hatfield, F.	O. P. H. Wynne	No. A.	A. Holt	Form 911 27.2.29 to 14.3.29	8.4.29

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received.
*† La Paz, M.V.	Benson, C. W.	J. D Richards	No. M.	Pacific S N. Co.	Form 911 4.2.29 to 11.3.29...	15.3.29
††55 Lapland	Harvey, H.	L. A. Williams, J C. Flett, J. A. Mackie.	W.T.	Red Star	W.T. Reg. 20.1.29 to 26.4.29 Form 911 21.4.29 to 26.4.29	29.4.29 29.4.29
*† Largs Bay	Jenkyn, W. M.	...	No. M.	Aberdeen Commonwealth.	Form 911 25.1.29 to 4.5.29	7.5.29
††64 Laurentic	Trant, E. L., R.D., Commr., R.N.R.	J. W. Peters, R. Hawkyns	W.T.	White Star	W.T. Reg. 26.2.29 to 5.3.29... Form 911 26.2.29 to 18.3.29	26.3.29 25.3.29
*† Lautaro, M.V.	Leyne, R. W.	J. T. Denley	No. M.	Pacific S.N. Co.	„ 27.11.28 to 12.1.29	22.1.29
*† Leicestershire	English, G. L.	R. S. Evans H. G. Walton, E. D. Brand, A. Thomson.	M.L.	Bibby	Met. Log. 2.2.29 to 10.4.29	17.4.29
Leighton, M.V.	Lindesay, J. M.	...	No. A.	Lamport & Holt	Form 911 1.5.28 to 20.5.28	19.6.28
Leitrim	Robertson, A....	S. J. Woodhouse	„ A.	Dowie, J., & Co.	„ 12.3.29 to 20.4.29	23.4.29
*† Limerick	Molyneux, P. L.	G. Chaplin	„ M.	Federal...	„ 18.1.29 to 24.2.29	18.3.29
Llandaff Castle	Gilbert, E. F....	W. A. Cooke	M.L.	Union Castle	„ 29.12.28 to 16.1.29	12.2.29
*† Llandovery Castle	Stuart, C. E., Capt. R.N.R.	C. H. Williams, G. Moon, P. Clissold.	M.L.	„ „	Met. Log. 15.11.28 to 21.1.29	1.2.29
Llanstephan Castle	Whitfield, G. J.	...	No. A.	„ „	...	...
*† Lobos, M. V.	Pape, E. R.	S. E. Ayland	„ M.	Pacific S.N. Co.	Form 911 8.3.29 to 25.3.29	16.4.29
Loch Katrine	Schlanbusch, O. V.	D. A. Mallinson	„ A.	R.M.S.P. Co.	„ 3.2.29 to 5.5.29 ...	10.5.29
*† Logician	Herschel, R F.	A. G. S. Madrell	„ M.	Harrison	„ 23.2.29 to 18.4.29	30.4.29
*† London Importer	Nuttall, E. L....	F. F Feint, J. H. Metcalfe, J. G. Freeman.	„ M.	Furness Withy	Met. Log. 8.1.28 to 31.3.28	14.4.28
Lord Antrim	Jarvis, F. E.	...	„ A.	Ulster S.S. Co.	Form 911 4.1.29 to 19.1.29...	23.1.29
Loriga, M.V.	Clapham, E. C.	D. P. Morgan	„ A.	Pacific S.N. Co.	„ 20.11.28 to 14.12.28	3.1.29
*† Losada, M.V.	Ross, J....	D. Beamer	„ M.	„ „	„ 5.3.29 to 19.4.29	29.4.29
†† Macedonia	Morton, A. J. Harrison, R.	C. J. L. Hayward	„ M.	P. & O.	„ 27.2.29 to 8.5.29...	16.5.29
*† Macharda	Hanna, R. G.	A. C. Hocking, H. M. Russell	„ M.	Brocklebank	„ 23.2.29 to 2.5.29	13.5.29
*† Maharaja	Elliott, G. F.	...	„ M.	Asiatic S.N. Co.	...	...
*† Mahronda	Addy, M. J.	J. Kettlewell	„ M.	„	„ 16.3.29 to 14.4.29	15.5.29
*† Mahsud	Kershaw, R. W.	J. D. Paisley	„ M.	„	„ 27.3.29 to 13.4.29	24.4.29
*† Maidan	Rowe, J. P.	...	„ M.	„	„ 12.3.29 to 6.4.29...	29.4.29
*† Maihar	Charlton, W. L.	J. W. B. Robertson, C. Cadwallader, A. D. Spring.	M L.	„	Met. Log. 2.11.28 to 10.3.29	8.4.29
*† Maimoa	Johnson, J. W.	D. Aitchison, A. D. Masters, R. Belford.	„	Shaw, Savill & Albion	„ 11.11.28 to 15.3.29	19.3.29
Maimyo	Smith, G. C.	H. M. Drummond	No. A.	Brocklebank	Form 911 18.8.28 to 14.11.28	29.11.28
††58 Majestic	Marshall, W, C.B., D. S. O., R. D., Commodore R.N.R.	W. W. Pearson, A. Fisher, W. T. Fitz Gerald, A. H. Young.	W.T.	White Star	W.T. Reg. 12.4.29 to 25.4.29	29.4.29
*† Makalla	Maugham, J. W.	A. L. Harrop	No. M.	Brocklebank	Form 911 25.3.29 to 2.5.29	10.5.29
** Makambo	Williams, D. J. McLean, J.	R. Perry, R. A. Williams S. Sandison.	M.L.	Burns Philp	Met. Log. 30.6.28 to 20.11.28	4.1.29
** Makura	Martin, W. Brown, J. F. S.	W. A. Todd, J. Billingham, G. Edwards.	„	Canadian-Australasian	„ 3.10.28 to 16.2.29	16.4.29
** Malabar, M.V.	Donaldson, A.	L. Millar	„	Burns, Philp & Co.	„ 5.5.28 to 14.10.28	2.1.29
*† Malakuta	Adamson, F. L.	N. Grayson	No. M.	Brocklebank	Form 911 30.11.28 to 9.4.29	6.5.29
*† Malancha	Whitham, F....	...	„ M.	„	„ 1.12.28 to 21.2.29	26.3.29
*† Malda	Gray, T. N.	...	„ M.	British India	„ 11.2.29 to 20.3.29	4.4.29
†† Maloja	Browning, J. B., R.D., Commr. R.N.R.	A. D. Dennis	„ M.	P. & O.	„ 14.3.29 to 18.4.29	29.4.29
†† Malwa	Stringer, R. H., O.B.E., R.D., Commr. R.N.R.	G. C. Case, F. D. Shaw	„ M.	„	„ 7.2.29 to 18.4.29	29.4.29
*† Manchester Brigade	Stott, C. H.	J. H. Round, H. Boyce, E. E. Bonnaud.	M.L.	Manchester Liners	Met. Log. 25.8.28 to 4.2.29	15.2.29
Manchester Corporation.	Makin, T.	J. F. Whitly	No. A.	„ „	Form 911 26.2.29 to 13.4.29	20.4.29
*† Manchester Hero	Riley, J. E. Barclay, J.	H. Anderton, J. H. Emmett, H. Dobson, A. Ricketts, A. Grant.	M.L.	„ „	Met. Log. 24.3.28 to 12.10.28	19.10.28
Manchester Producer	Struss, F. D.	...	No. A.	„ „	Form 911 2.3.29 to 31.3.29	3.4.29
*† Manela	Maples, S. H....	...	„ M.	British India...	„ 10.3.29 to 30.3.29	29.4.29
*† Mangalore	Mulchay, G.	...	„ M.	Brocklebank	...	...
*† Manipur	Cochran, G. N.	R. Penston, G. B. Falconer	„ M	Brocklebank	„ 4.3.29 to 1.4.29 ...	22.4.29
Manistee	Pengelly, J.	...	„	Elders & Fyffes	...	...
*† Manora	Hudson, H. T., R.D., Commr., R.N.R.	...	„ M.	British India...	Form 911 30.12.28 to 28.3 29	2.4.29
†† Mantua	Davis, H. C., D.S.C., Commr., R.N.R.	...	„ M.	P. & O.	„ 4.11.28 to 7.2.29...	25.2.29
** Marella	Mortimer, S.	...	M.L.	Burns Philp	Met. Log. 3.7.28 to 18.9.28...	19.1.29
*† Marengo	Curle, J.	H. Bryan, G. W. Revell, F. Foval, S. Butcher.	„	Ellerman Wilson	„ 18.7.28 to 6 1.29...	22.1.29
Maresfield	Berry, V.	T. Connolly	No. A.	Woods, Tyler & Brown	Form 911 3.5.28 to 19.5.28...	9.6.28
†† Margha	Hughes, C. G...	P. Wright, H. Watkins	M.L.	British India...	Met. Log. 1.12.28 to 28.2.29	5.3.29
*† Marquesa	Smiles, R. S.	L. Owen...	No. M.	Furness Houlder	Form 911 27.1.29 to 29.3.29	15.4.29
Marsina	Williams, G. E.	...	„ A.	Burns, Philp & Co.	„ 4.2.29 to 2.3.29 ...	8.4.29
*† Matakana	Thurston, H. P.	E. Davies, B. Forbes-Moffatt, J. Dickson.	M.L.	Shaw, Savill & Albion	Met. Log. 29.9.28 to 11.2.29	13.2.29
Mataram	Voy, W.	...	No. A.	Burns Philp & Co.	Form 911 23.1.29 to 22.2.29	2.4.29
†† Mataroa	Kershaw, W. A. R.	F. Eadon. J. J. Nicoll, C. Meyer.	M.L.	Shaw, Savill, & Albion	Met. Log. 28.9.28 to 4.1.29	7.1.29
*† Matheran	Ison, W. A.	J. Richardson	No. M.	Brocklebank	Form 911 6.11.28 to 18.11.28	23.11.28
*† Matiana	Green, F. V.	...	„ M.	British India...	„ 4.12.28 to 12.2.29	16.3.29
*† Matra	Cornish, N. P.	W. Gibson	„ M.	Brocklebank	„ 28.11.28 to 23.3.29	27.3 29
** Maunganui...	Martin, W.	A. J. Herbert	„ M	Union S.S. Co. of N.Z	„ 22.2.29 to 18.3.29	22.4.29
††32 Mauretania	McNeil, S. G.S., R.D., Capt., R.N.R.	R. H. C. Crawford, C. B. Osborne, B. J. P. Tuck.	W.T.	Cunard	W.T. Reg. 31.3.29 to 15.4.29 „ 21.4.29 to 6.5.29...	18.4.29 9.5.29
††66 Megantic	Kearney, J.	F. E. Patchett	W.T.	White Star	„ 5.2.29 to 26.4.29	9.5.29
††22 Melita	Stewart, A.	J. Shearer	W.T.	Canadian Pacific	W.T. Reg. 8.4.29 to 25.4.29	30.4.29
Memnon	Watson, C. J.	J. A. C. McGregor	No. A.	A. Holt...	Form 911 12.1.29 to 23.1.29	28.1.29
††21 Metagama	McCombie, G. F., R.D., Commr., R.N.R	C. L. de H. Bell, J. Stewart, J. Coldwell	W.T.	Canadian Pacific	W.T. Reg. 7.4.29 to 24.4.29	29.4.29
*† Middlesex	Wilde, H.	D. J. Murray,	No. M.	Federal...	Form 911 22.1.29 to 6.2.29	5.3.29
Minna	Mackenzie, G. G.	A. M. Campbell	„ A.	Scottish Fishery Brd.	„ 28.2.29 to 25.3.29	2.4.29
††23 Minnedosa	McQueen, D. S.	C. D. Watt, W. J. P. Roberts. H. M. Sanders.	W.T.	Canadian Pacific	W. T. Reg. 28.3.29 to 13.4.29 „ 21.4.29 to 12.5 29 Form 911 27.3.29 to 13.5.29	16.4.29 16.5.29 15.5.29
†† Minnesota	Finch, E., R. D., Commr. R.N.R.	...	No. M.	Atlantic Transport	Form 911 27.11.28 to 16.12.28	28.12.28
†† Minnetonka	Gates, T. F., C.B.E.	H. E. D. McCartney	„ M.	„ „	„ 14.4.29 to 4.5.29	7.5.29

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received.
†† _Minnewaska_ ...	Claret, F. H., C.B.E., Commr., R.N.R.	F. J. Mummery	No. M.	Atlantic Transport ...	Form 911 1.4.29 to 20.4.29... ...	24.4.29
Mississippi	Hutchinson, J. G. ...	W. M. Shoesmith	,, A.	,, ,, ...	,, 18.3.29 to 3.5.29 ...	6.5.29
*† _Modasa_	Gilchrist, J. W. ...	A. E. Baker, E. Crozier ...	,, M.	British India	,, 10.6.28 to 28.8.28 ...	18.9.28
Moeraki	Loriard. C.	F. E. Lucas, D. J. Strath ...	,, A	Union S.S. Co. of N.Z.	,, 22.2.29 to 31.3.29 ...	13.5.29
†† _Moldavia_	Burleigh, C. W., D.S.O., R.D., Capt., R.N.R.	C. B. Holmes	,, M.	P. & O.	,, 25.2.29 to 15.3.29 ...	22.4.29
†† _Mongolia_	Furlong, G. H. S., R D., Capt., R.N.R..	A. H. Cole	,, M.	,, ...	,, 17.2.29 to 1.5.29... ...	6.5.29
††24 _Montcalm_ ...	Rothwell, A.	F. H. Steel	W.T.	Canadian Pacific ...	W.T. Reg. 15.4.29 to 4.5.29... ...	9.5.29
††25 _Montclare_ ...	Griffiths. J. N. ...	E. A. Shergold, T. L. Gillette, T. Sargent.	,,	,, ,,	,, 20.4.29 to 9.5.29 ...	13.5.29
** _Montoro_	Williams, D. J. ...	D. J. L. Pemberton, R. M. Blunt, J. Campbell,	M.L.	Burns, Philp & Co. ...	Met. Log. 15.3.28 to 12.7.28 ...	31.10.28
†† _Montrose_ ...	Dott, J. F.	J. Soame, J. M. Roche ...	No M.	Canadian Pacific ...	W.T. Reg. 8.4.29 to 26.4.29 ...	30.4.29
††20 _Montroyal_ ...	Freer, A.. R.D., Capt., R.N.R.	L. Outram, D. Ewing ...	W.T.	,, ,,	,, 1.4.29 to 16.4.29... ... Form 911 8.12.28 to 27.12.28 ...	20.4.29 3.1.29
** _Moresby_	Henderson, D. A., Commr., R.N.	G. A. Gould	M.L.	His Majesty's Australian Ship.	Met. Log. 7.8.28 to 13.12.28 ...	13.3.29
†† _Morvada_	Mills, T. L., O.B.E., R.D., Commr. R.N.R.	A. J. Norris, H. Maguire ...	No. M.	British India	Form 911 29.7.28 to 29.10.28 ...	31.10.28
†† _Mulbera_	Caffyn. F.	J. B. B. Robertson	,, M.	,, ...	,, 14.1.29 to 12.2.29 ...	11.3.29
*† _Nagara_	Miles, F. R., R.D., Capt. R.N.R.	A. H. Frogbrook	,, M.	R.M.S.P. Co.	,, 16.2.29 to 11.4.29 ...	15.4.29
*† _Nagoya_	Cochrane, C. H. ...	S. Spring	,, M.	P. & O.	,, 23.12.28 to 15.3.29 ...	2.5.29
†† _Naldera_	Randell, G. G. ...	C. H. Hand, M. F. Shute, J. C. Davies.	M.L.	,, ...	Met. Log. 20.10.28 to 23.1.29 ...	8.2.29
*† _Nardana_	Moth, F. L.	F. G. Sharps	No. M.	British India	Form 911 8.10.28 to 13.11 28 ...	3.12.28
†† _Narkunda_	Parker, J. J. W., R.D., Commr. R.N.R.	M. Boyd	,, M.	P & O.	,, 9.3.29 to 28.3.29 ...	22.4.29
*† _Nellore_	Hignett, A. H., R.D., Lt.-Commr., R.N.R.	T. A. Sergeant	,, M.	P. & O.	,, 18.3.29 to 17.4.29 ...	29.4.29
*† _Nerbudda_	Williams, B. N. ...	G. A. Farley, S. Henderson ...	,, M.	British India	,, 16.12.28 to 8.2.29 ...	11.2.29
*† _Nestor_	Houghton, G. K. ...	C. Mackinnon	M.L.	A. Holt	,, 2.4.29 to 9.5.29 ...	15.5.29
*† _Newby Hall_ ...	Gorst, W.	E. M. Robertson. F. Wrigley, A. W. Wise, W. S. Smith.	No. M.	Ellerman	Met. Log. 17.8.28 to 27.1.29 ...	18.2.29
*† _Newfoundland_ ...	Foxworthy, A. W.	R. F. Handley, E. Sainty, D. Hetherington.	M.L.	Furness Withy ...	,, 4.1.29 to 7.5.29	14.5.29
** _Niagara_ ...	Brown, J. F. S. ... Hill, T. V.	V. Knight, J. Hood, L. Ehlert.	,,	Canadian-Australasian	,, 15.11.28 to 28.2.29 ...	2.4.29
Ningchow	Beale, H. E.	H. Morley	No. A.	A. Holt...	Form 911 18.3.29 to 21.4.29 ...	23.4.29
*† _Nirvana_	Ayres, R. M.	J. K. Ridger	,, M.	British India	,, 7.1.29 to 15.2.29 ...	18.3.29
Norfolk	Mead, G. F.	A. Hocken	M.L.	Federal	,, 30.12.28 to 6.2.29 ...	8.2.29
Norna	Wright, J. W.... ...	T. R. Ness	No. A.	Scottish Fishery Brd	,, 7.3.29 to 27.4.29 ...	10.5.29
*† _Norseman_, C.S. ...	Davis, E. R.	R. W. Greenfield	,, M.	Western Tel. Co. ...	,, 30.1.29 to 7.3.29 ...	8.4.29
*† _Northumberland_ ...	Upton, H. L., D.S.C., R.D., Lt.-Commr. R.N.R.	W. J. Glassborow, H. R. M. Smith, R. S. Miller.	M.L.	Federal	Met. Log. 26.11.28 to 15.4.29 ...	26.4.29
Nova Scotia ...	Furneaux, S.... ...	... ...	No. A	Furness Withy ...	Form 911 11.4.29 to 18.4.29 ...	24.4.29
*† _Nowshera_	Parker, A. A.... ...	W. Ashcroft, A. Baillie ...	,, M.	British India	,, 9.3.29 to 1.4.29	29.4.29
*† _Nuddea_	Morrison, W. C. ...	A. W. Smith	,, M	British India... ...	,, 12.2.29 to 9.3.29 ...	13.3.29
Oaklands Grange	St. Clair, C., D.S.C. ...	C. F. Foxwell	,, A.	Houlder Bros. ...	Form 911 1.1.29 to 25.1.29... ...	28.1 29
††57 _Olympic_	Parker, W. H., C.B.E., R.D., Capt. R.N.R.	A. E. Harvey, A. E. Dyer, J. Day, J. W. Paine.	W.T.	White Star ...	W.T. Reg. 29.3.29 to 10.4.29 ... ,, 18.4.29 to 2.5.29... ...	16.4.29 6.5.29
†† _Orama_	Matheson, C. G., D.S.O., R.D., Capt., R.N.R.	J. M. M. Swanson. C. K. Blake, J. D. Archer.	M.L.	Orient	Met. Log. 11.11.28 to 12.2.29 ...	15.2.29
Oranian	Arkle, J.	.. ..	No. A.	Leyland	Form 911 25.11.28 to 2.1.29 ...	19.3.29
†† _Orbita_	Dominy, R. H., C.B.E. Commr., R.N.R.	J. R. Bubb	,, M.	Pacific S.N. Co. ...	,, 31.1.29 to 18.4.29 ...	23.4.29
†† _Orcoma_	Harvey, J. G.... ...	T. J. Waylor, R. H. Sissons, J. W Fraser, J. Allan.	,, M.	,, ,, ...	Met. Log. 31.5.28 to 14.8.28 ...	30.8.28
†† _Orduna_	Daniel, T.	R. D. Eckford, W. Pearce ...	,, M.	,, ,, ...	Form 911 12.1.29 to 28.3.29 ...	2.4.29
Orestes	Flynn, G. A.	R. Martin...	,, A.	A. Holt...	,, 28.7.28 to 8.9.28 ...	26.11.28
†† _Orford_	Owens, A. L., Commr. R.D., R.N.R.	O. C. Davies	,, M.	Orient	,, 14.2.29 to 26.4.29 ...	11.5.29
†† _Orita_	Barkley, E	D. W. Hutchinson, G. W. Irvine, L. L. Hunter.	M.L.	Pacific S.N. Co. ...	Met. Log. 18.6.28 to 27.11.28 ...	4.12.28
†† _Ormonde_	Rice, W. V., D.S.O., D.S.C., Commr. R.N.	H. P. Price	,,	His Majesty's Ship...	,, 9.8.28 to 2.11.28 ...	8.1.29
†† _Oronsay_	Shelford, W. S., Lt.-Commr., R.N.R.	T. Fox Russell, R. S. Hawker, K. M. Morrison.	M.L.	Orient	,, 28.10.28 to 29.1.29 ...	31.1.29
*† _Oroya_	Ridyard, A.	P. H. Ray	No. M.	Pacific S.N. Co. ...	Form 911 19.2.29 to 29.4.29 ...	11.5.29
†† _Orsova_	Thorne, G. G., R.D., Commr., R.N.R	L. J. Vesty, N. W. Smith, J. D. Birch.	M.L.	Orient	Met. Log. 9.12.28 to 12.3.29 ...	15.3.29
†† _Orvieto_	O'Sullevan, F. R. ...	G. L. Carter, H. A. Whittle. C. D. Lane.	,,	,, ...	,, 23.12.28 to 27.3.29 ...	4.4.29
†† _Osterley_	Sarson, M. J	G. B. H. Jones	No. M.	,, ...	Form 911 26.11.28 to 26.2.29 ...	5.3.29
Otaki	Clarke, C.	G. Dibley	M.L.	New Zealand S.S. Co.	,, 3.1.29 to 1.3.29 ...	8.3.29
†† _Otranto_	Staunton, H. G., C.B.E., R.D., Commr., R.N.R.	O. C. Davies	No. M.	Orient	,, 29.1.28 to 30.3.28 ...	14.4.28
Oxfordshire ...	Foster, W. L.	E. A. Insley	,, A.	Bibby Bros.	,, 24.1.29 to 21.2.29 ...	4.3.29
Pacific Shipper, M.V.	Goodwin, J.	... ...	,, A.	Furness Withy ...	,, 5.9.28 to 4.12.28... ...	28.12.28
*† _Pakeha_	W. P. Clifton Mogg, Lt.-Commr., R.N.R.	H. C. Smith, G. Almond, B. M. Morris	M.L.	Shaw, Savill & Albion	Met. Log. 1.12.28 to 5.5.29... ...	10.5.29
*† _Pancras_ ...	Reynolds, H. B. W.... Jones, W. C. H. ...	C. C. Beal, E. Owen, R. Parry.	M.L.	Booth	,, 31.7.28 to 5.2.29 ...	1.3.29
*† _Parana_	Rathkins, C. E., R.D., Commr., R.N.R.	C. J. Murray	,,	R.M.S.P.	... ...	...
Pareora	Evans, J. O.	J. Greenaway	No. A.	Hain S.S. Co.	Form 911 7.8.28 to 7.9.28 ...	19.11.28
Paris	Cook, C. L.	Mr. Biles	C.C.	Southern Rly. ...	Telegraphic Report. 2.4.29 ...	2.4.29
Patia	Makepeace, S. ...	J. Green	No. A.	Elders & Fyffes ...	Form 911 18.8.28 to 22.9.28 ...	25.9.28
Peisander	Slater, H. N.	H. E. Readshaw	,, A.	A. Holt...	,, 3.3.29 to 31.3.29... ...	29 4.29
Pennland	Making, V. L. ...	C. J. Murray	,, A.	Red Star	,, 14.4.29 to 3.5.29... ...	6.5.29
*† _Peshawur_	McBryde, A. M. ...	K. A. H. Cummins, S. H. Baldwin, A. M. Tolfree.	M.L.	P. & O.	Met. Log. 10.12.28 to 1.5.29 ...	13.5.29

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received
Polycarp	Reynolds, W. H. B.	H. W. Taggart	No. A.	Booth	Form 911 31.3.29 to 11.4.29	25.4.29
*† *Port Adelaide*	Swan, L. H.	R. B. Linklater, C. J. Gorley, F. J. Lavers.	M.L.	Commonwealth & Dominion.	Met. Log. 20.7.28 to 14.12.28	28.12.28
*† „ *Auckland*	Durham, R. S., D.S.C	C. F. Post, E. R. Rowlands, W. Roberts, E. W. Dingle.	„	„ „ „	„ 28.8.28 to 24.1.29	21.2.29
„ *Bowen*	Hearn, G. W.	S. Ray	No. A.	„ „ „	Form 911 9.9.28 to 17.9.28...	26.10.28
*† „ *Campbell*	Needham, R.	J. G. Thom	M.L.	„ „ „	„ 15.8.28 to 6.1.29...	14.1.29
*† „ *Caroline*	Brown, A. H.	J. B. Bradley, G. Langford, J. Stannard. L. J. Brice	„	„ „ „	Met. Log. 26.10.28 to 3.4.29	8.4.29
*† „ *Darwin*	Sawbridge, I. R.	H. Pinkney, E. M. Fenton, S. Moate.	„	„ „ „	„ 2.9.28 to 3.1.29 ...	7.1.29
** „ *Denison*	Ferris, J.	L. W. Cady. A. A. Cooper, E. Beard, J. Rowland-Hill.	„	„ „ „	„ 10.10.28 to 14.3.29	1.4.29
„ *Dunedin*, M.V.	Farmar, F.	H. M. Post, V. G. Battle. W. Hopkins.	„	„ „ „	„ 19.12.28 to 15.4.29	23.4.29
„ *Fremantle*, M.V.	Gilling, W.	... ...	No. A.	„ „ „	Form 911 18.4.29 to 2.5.29...	6.5.29
„ *Gisborne*, M.V	Hayter, S. W.	H. Boys-Smith	„ A.	„ „ „	„ 2.1.29 to 1.5.29 ...	11.5.29
*† „ *Hobart. M. V.*	Cottell, S. C.	L. Copeland, C. L. Webb. G. J. O. Jinman, W. B. Craig	M.L.	„ „ „	Met. Log. 21.11.28 to 23.3.29	3.4.29
*† „ *Hunter*	Robinson, C. A.	R.B. Stannard, A. McClounan. J. T. Weldin.	„	„ „ „	„ 1.8.28 to 23.12.28	31.12.28
„ *Huon*	Compton, J. E.	... ...	No. A.	„ „ „	Form 911 6.3.29 to 3.4.29 ...	10.4.29
*† „ *Melbourne*	Kippins, T.	W. G. Jones, F. W. Elgar, W. E. Simpson.	M.L.	„ „ „	Met. Log. 23.11.28 to 21.4.29	25.4.29
*† „ *Nicholson*	Jack, J.	J. H. Sloan, T. L. Kidwell, J. A. D. Fisher.	M.L.	„ „ „	Met. Log. 12.9.28 to 30.1.29	27.2.29
*† „ *Pirie*	Hudson, J. J.	E. H. Rogerson, A. Cooper, A. Brown.	„	„ „ „	„ 26.11.28 to 22.4.29	3.5.29
*† „ *Sydney*	Higgs, W. G.	E. E. Roswell, F. R. Gorman, R. D. Chamberlain.	„	„ „ „	„ 25.9.28 to 29.1.29	8.2.29
*† „ *Victor*	Williams, R.	W. Pickup, C. Hodson, C. E. Midwinter.	„	„ „ „	„ 14.7.28 to 1.1.29...	23.1.29
„ *Wellington*	Jones, C. N.	L. J. Skails	No. A.	„ „ „	Form 911 5.1.29 to 16.2.29...	20.2.29
Protea, H.M.S.A.S.	Dalgleish, J., Lt.-Commr., S.A.N.S.	F. J. Dean	M.L.	South African Naval Service.	Met. Log. 16.10.28 to 20.2.29	21.3.29
*† *Protesilaus*	Quirk, T. W.	J. Milhench, A. E. Martin, E. A. H. Gepp.	„	A. Holt	„ 20.11.28 to 24.4.29	14.5.29
Pyrrhus	Elford, W. J.	... ...	No. A.	„	Form 911 5.3.29 to 20.3.29...	13.5.29
*† *Quiloa*	Cave, S. G.	E. M. B. Heath, W. Welch	„ M.	British India...	„ 31.7.28 to 21.1.29	20.2.29
†† *Rajputana*	Cadiz, F. G., D.S.C.	R. E. Tucker	„ M.	P. & O.	„ 16.2.29 to 11.4.29	17.4.29
†† *Ranchi*	Brooks. C., D.S.O., R.D., Commr., R.N.R.	... ...	„ M.	P. & O.	„ 9.3.29 to 24.4.29...	29.4.29
†† *Ranpura*	King, A. M., D.S.C.	E. J. Spurling	„ M.	P. & O.	„ 13.4.29 to 1.5.29...	3.5.29
†† *Razmak*	Harrison, R., D.S O., R.D., Capt. R.N.R.	... ...	„ M.	P. & O.	... ...	...
††60 *Regina*	Davies, E.	R. S. Walker, E. A. A. Crowley, C. W. R. Campbell	W.T.	White Star - Dominion	„ 22.4.29 to 11.5.29 W.T. Reg. 21.4.29 to 11 5.29	13.5.29 14.5.29
*† *Remuera*	Cameron, J. J.	H. Harwood, C. R. Pilcher, T. S. Marchington, R. C. Aldridge.	M.L.	New Zealand S.S. Co.	Met. Log. 24.11.28 to 15.3.28	17.4.28
Rhexenor	Stout, G. L.	W. E. Barrett	No. A.	A. Holt...	Form 911 14.3.29 to 21.4.29	10.5.29
Rhodesian Transport.	Bullock, F. W. H.	J. G. Freeman	„ A.	Houlder Bros.	„ 6.9.28 to 24.12.28	28.12.28
*† *Rimutaka*	Holland, E.	F. Pretty. H. S. Cashmore, F. Cooke, E. Foster.	M.L.	New Zealand S.S. Co.	Met. Log. 31.8.28 to 3.1.29...	7.1.29
Ripley Castle	Aylen. C. E. H.	A. C. J. Hatt	No. A.	Union Castle	Form 911 8.1.29 to 9.4.29 ...	15.4.29
Rother	Woodhead, T. H.	N. Thompson	„ A.	Goole Steam Shipping	„ 9.2.29 to 13.3.29...	2.4.29
*† *Rotorua*	Hunter, J. L. B.	L. Griffiths, T. M. Devitt, H. Cockerill.	M.L.	New Zealand S.S. Co.	Met. Log. 26.10.28 to 16.2.29	26.2.29
Royal Transport	Oliver, R. C.	R. Hughes	No. A.	Houlder Bros.	Form 911 17.6.28 to 15.9.28	21.9.28
*† *Ruapehu*	McKellar, A. W., R.D., Capt., R.N.R.	H. N. Lawson, E. H. Hopkins, L. F. Malcouronne.	M.L.	New Zealand S.S. Co.	Met. Log. 2.11.28 to 11.3.29...	15.3.29
** *St. Albans*	Diamond, S. L.	R. L. Harry, J. D. Kavanagh. F. O. Colvin.	„	Eastern and Australian.	„ 4.12.28 to 27.3.29	9.5.29
St. Helier	Richardson, L.	C. Bell	C.C.	G.W. Railway	Telegraphic Report 14.5.29	14.5.29
St. Julien	Pitman, R.	C. W. Sanderson	„	„ „	„ „ 11.4.29	11.4.29
St. Andrew	Bearpark, E. W.	J. Meade	No. A.	Rankin Gilmour	Form 911 1.1.29 to 19.2.29...	16.3.29
††38 *Samaria*	Malin, R. G., Lieut.-Commr., R.N.R.	F. D. Thomas, D. McMillan, P. G. Britten.	W.T.	Cunard	W.T. Reg. 14.4.29 to 4.5.29	9.5.29
Sardinian Prince	Pearson, F. T.	G. A. Davies	No. A.	Prince	Form 911 1.3.29 to 4.4.29 ...	29.4.29
Saxon	Shilston, P. G., R.D., Capt. R.N.R.	E. V. Quickenden	„ A.	Union Castle	„ 3.2.29 to 24.3.29...	27.3.29
*† *Scholar*	Peterkin, A. G.	G. Baker	„ M.	Harrison	„ 20.1.29 to 16.4.29	24.4.29
Scotia	Prichard, S. D., M.B.E.	W. L. Hughes	C.C	L.M. & S. Railway	Telegraphic Report 3.5.29...	3.5.29
††33 *Scythia*	Irving, R. B., O.B.E., R.D., Capt. R.N.R.	R. Sell, G. H. Morris, J. G. Bradley.	W.T.	Cunard	W.T. Reg. 8.4.29 to 28.4.29 Form 911 7.4.29 to 29.4.29...	6.5.29 3.5.29
Sheaf Mount	Groves, C. V.	A. Macarthur	No. A.	W. A. Souter	„ 26.3.29 to 24.4.29	4.5.29
*† *Sheaf Spear*	Whitfield, G. A., O.B.E.	P. L. Hay	M.L.	„	Met. Log. 2.9.28 to 17.1.29	1.2.29
*† *Shropshire*, M.V.	Adamson, B. W.	W. L. Whiteside, R. Cuming, W. H. Brittain.	„	Bibby	„ 8.2.29 to 19.4.29...	22.4.29
** *Sinkiang*	Stringer, C. B. L.	... ...	„	China Navigation Co.	... ...	...
Somerset	Howell Price, J.	W. Redwood	„	Federal...	Form 911 26.1.29 to 12.3.29	18.3.29
*† *Spero*	Montgomery, H.	H. W. Vickers	„	Ellerman Wilson	Met. Log. 6.7.28 to 12.1.29...	22.1.29
*† *Statesman*	Mowat, J.	C. V. Watts	No. M.	Harrison	Form 911 31.1.29 to 12.4.29	10.5.29
Stephen	Evans, L. G.	L. Mc Millan	„ A.	Booth	„ 27.3.29 to 9.4.29...	18.4.29
Stockwell	Smith. W.	F. Moore	„ A.	Brocklebank	„ 26.10.28 to 22.11.28	28.12.28
Surrey	Mac Rae, A. B.	A. V. Pearce	M.L.	Federal...	„ 5.11.28 to 12.3.29	6.4.29
Sutton Hall	Walmsley, R. J.	... ...	No. A.	Ellerman	„ 5.3.29 to 26.3.29...	16.4.29
Sylvafield, M.V	Xing, J. F.	A. A. Tully	„ A.	Hunting & Son	„ 6.3.29 to 8.4.29 ...	26.4.29
Tainui	Elford, H. E.	L. J. Hopkins	„ A.	Shaw, Savill & Albion	„ 22.12.28 to 26.1.29	2.2.29
Tahiti	Aldwell, B. M.	F. W. Bales	„ A.	Union S.S. Co. of N.Z.	„ 14.3.29 to 11.4.29	3.5.29
** *Taiping*	Frame, A. M.	F. Stratford, A. C. Kennedy, E. S. Birrell	M.L.	Yuill & Co.	Met. Log. 14.9.28 to 5.1.29	13.2.29
*† *Takada*	Lindon, J.	... ...	No. M.	British India	... ...	...
*† *Talma*	Hocking. R. W., R.D., Lieut.-Commr., R.N.R.	A. R. Andrew...	„ M.	„	Form 911 24.2.29 to 6.4.29...	6.5.29
Talthybius	Wilson, R. J.	... ...	M.L.	A. Holt	„ 12.12.28 to 29.12.28	17.1.29

Name of Vessel.	Captain.	Observing Officers.	Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 16.5.29.	Date Received.
†† *Tamaroa*	Hartman, W. H.	A. J. Galvin	No. M.	Shaw, Savill & Albion	Form 911 10.11.28 to 21.2.29	11.3.29
** *Tanda*	Pilcher, E. T., Lieut.-Commr., R.N.R.	G. C. Smith, H. Murday, H. Nuzum.	M.L.	E. & A. S.S. Co.	Met. Log 16.10.28 to 19.2.29	6.4.29
*† *Taranaki, M.V.*	Wood, C.	A. Chrystal, G. Campbell, P. Savill.	,,	Shaw, Savill & Albion	,, 17.10.28 to 12.2.29	27.2.29
Tarantia	Henderson, F. M.	N. H. King	No. A.	Anchor	Form 911 29.12.28 to 5.2.29	1.3.29
Teiresias	Wilkinson, W. H.	R. Blakey	,, A.	A. Holt & Co.	,, 2.12.28 to 23.3.29	8.4.29
*† *Tekoa*	Robinson, F. W.	T. K. MacDonald	,, M.	New Zealand S.S. Co.	,, 4.1.29 to 13.3.29...	16.3.29
Telamon	Willcox, J. H	F. A. Brown	,, A.	A. Holt	,, 12.2.29 to 27.3.29	13.5.29
Tetela	Brice, E. H.	F. E. Holmes	,, A.	Elders & Fyffes	,, 10.2.29 to 26.4.29	30.4.29
Teucer	Beswick, W., D.S.C., Lt.-Commr., R.N.R.	W. F. Cook, H. Rudd	,, A.	A. Holt	,, 31.1.29 to 30.3.29	4.4.29
†† *Themistocles*	Young, A. D.	...	,, M.	Aberdeen Commonwealth	,, 12.12.28 to 20.1.29	28.1.29
Theseus	Carnon, C. G.	E. F. Bayes	,, A.	A. Holt	,, 17.11.28 to 26.3.29	20.4.29
*† *Tilawa*	Rowe, P. W.	E. A. Rabey	,, M.	British India	,, 10.3.29 to 28.3.29	29.4.29
*† *Tinhow*	Andoe, G.	J. S. King	,, M.	A. Weir & Co.	...	...
*† *Titan*	Power, J. J.	P. Cross, R. A. Shennan, C. F. Bailey.	M.L.	A. Holt	Met. Log. 19.8.28 to 3.1.29	14.1.29
*† *Tongariro*	Burton Davies, J	E. A. Burton, A. E. Williams, H. Wilkinson, D. Baldwin.	,,	New Zealand S.S. Co.	Met. Log. 12.8.28 to 7.1.29	18.1.29
Transylvania	Erskine, R.	P. Middleton	No. A	Anchor	Form 911 23.9.28 to 10.11.28	20.11.28
Trefusis	Hunt, D.	R. H. Silley	,, A.	Hain S.S. Co.	,, 7.2.29 to 13.2.29...	23.4.29
*† *Trematon*	Evans, B.	J. Jenkyn, C. M. Quick, R. Stitson.	M.L.	Hain S.S. Co.	Met. Log. 18.5.28 to 24.12.28	7.1.29
*† *Turakina*	Field, H. G. B.	J. D. B. Fisher	No. M.	New Zealand S.S. Co.	Form 911 1.12.28 to 28.12.28	14.1.29
††11 *Tuscania*	Rome, W. B.	J. Noble	W.T.	Anchor	W.T. Reg. 26.11.28 to 16.12.28 Form 911 24.11.28 to 17.12.28	22.12.28 20.12.28
*†*Tyndareus*	Hughes, R. T.	A F. Barclay, F. V. Smith, D. S. Bruce.	M.L.	A. Holt	Met. Log. 30.10.28 to 31.3.29	14.5.29
** *Ulimaroa*	Wylie, W. J.	S. B. Komall	No. M.	Huddart Parker, Ltd.	Form 911 15.2.29 to 11.3.29	15.4.29
Ulysses	Owen, R. D., O.B.E.	A. McDonald	,, A.	A. Holt	,, 2.3.29 to 22.3.29	16.4.29
Umvolosi	Barnes, E. W.	R. Dyns	,, A.	Bullard King	,, 6.2.29 to 19.4.29	14.5.29
*† *Upwey Grange*	Goodrick, H. P.	G. T. Hurst	,, M.	Houlder	,, 1.4.29 to 17.4.29	13.5.29
Vardulia	Fear, E. T. C.	W. H. Barker	,, A.	Cunard	Form 911 1.12.28 to 11.1.29	15.1.29
†† *Viceroy of India*	Ohlson, B. J, D.S.O., R.D., Commr. R.N.R.	A. G. Stansfield	,, M.	P. & O.	...	...
Vigilant	Simpson, E. S. S.	J. H. Hennessey	,, A.	Scottish Fishery Board.	Form 911 1.4.29 to 30.4.29...	6.5.29
** *Waiotapu*	Todd, D.	L. Leeder	,, M.	Canadian - Australasian.	,, 17.2.29 to 14.3.29	6.4.29
** *Wairuna*	Ryan J.	H. W. Jones, E. A. Stein, E. R. Pate.	M.L.	Union S.S. Co. of N.Z.	Met. Log. 19.10.28 to 21.1.29	15.3.29
Walmer Castle	Morton Betts, W.	G. H. Pickering	No. A.	Union Castle	Form 911 16.2.29 to 7.4.29...	9.4.29
Warfield	Steel, R.	...	,, A.	,, ,,	Form 911 2.2.29 to 21.3.29...	2.4.29
*† *War Nizam*	Moncrieff, T.	F. J. Marshall	,, M.	British Tankers	,, 5.5.28 to 11.6.28	26.6.28
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†† *William Scoresby*, R.S.S.	Shannon, R. L. V., Lieut.-Commr. R.N.	M. C. Lester	,,	Falkland Islands Government.	,, 22.9.28 to 19.1.29	11.5.29
†† *Windsor Castle*	Chave, Sir B., K B.E.	A. J. Tweddell, C. Gorringe, R. Tyser.	,,	Union Castle	,, 25.8.28 to 17.2.29	21.2.29
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*† *Woodarra*	Reilly, J. V	H. Goater, L. J. C. Simpson, G. F. Alexander J. McPhail.	M.L.	British India	Met. Log. 15.7.28 to 31.12.28	4.1.29
Zent	Roberts, H.	...	No. A.	Elders & Fyffes	Form 911 17.3.29 to 22.4.29	24.4.29
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Dakotian	Robb, J.	W. F. Sloan	,,	,, ,,	5.4.29
Darro	Matthews, G. P.	J. Clark	R.M.S.P. Co.	,, ,,	5.10.28
Deseado	Hannan, F. S.	J. G. Scott	,,	,, ,,	18.10.28
Hildebrand	Peregrine, D.	E. Jones	Booth	,, ,,	11.3.29
Oranian	Bolton, W.	T. J. Jones	Leyland	,, ,,	19.3.29

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Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the Best Routes across the Equator. (No. 27, 1876) 24*s.* (17 × 20 in.)

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Meteorological Charts of the North Atlantic for each month of the year, giving normals of Pressure, Air and Sea Surface Temperature and Ocean Currents, with Frequencies of Winds, also Ice Limits. (No. 149A, 1923) 1*s.* each (35 × 22½ in.). Sold by J. D. Potter, 145, Minories, E.1.

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Atlantic (South) :—

Wind Charts for the Coastal Regions of South America, from information collated and prepared in the Meteorological Office. (No. 159, 1902.) (27 × 20½ in.) (Published by the Admiralty.)

The relation between Pressure, Temperature, and Air Circulation over the South Atlantic Ocean. By M. W. Campbell Hepworth, C.B., Commander R.N.R., Marine Superintendent. (No. 177, Second Edition, 1917.) 1*s.* (8vo.)

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Indian Ocean :—*continued.*

Monthly Current Charts for the Indian Ocean, from information collated and prepared in the Meteorological Office. (No. 124, 1896.) (20 × 24½ in.) (Published by the Admiralty.)

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